AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

VOL. 14, No. 2. WEEKLY. | NEW YORK, THURSDAY, JANUARY 8, 1891. | $3.00 per Annum. SINGLE COPIES 6 CENTS.

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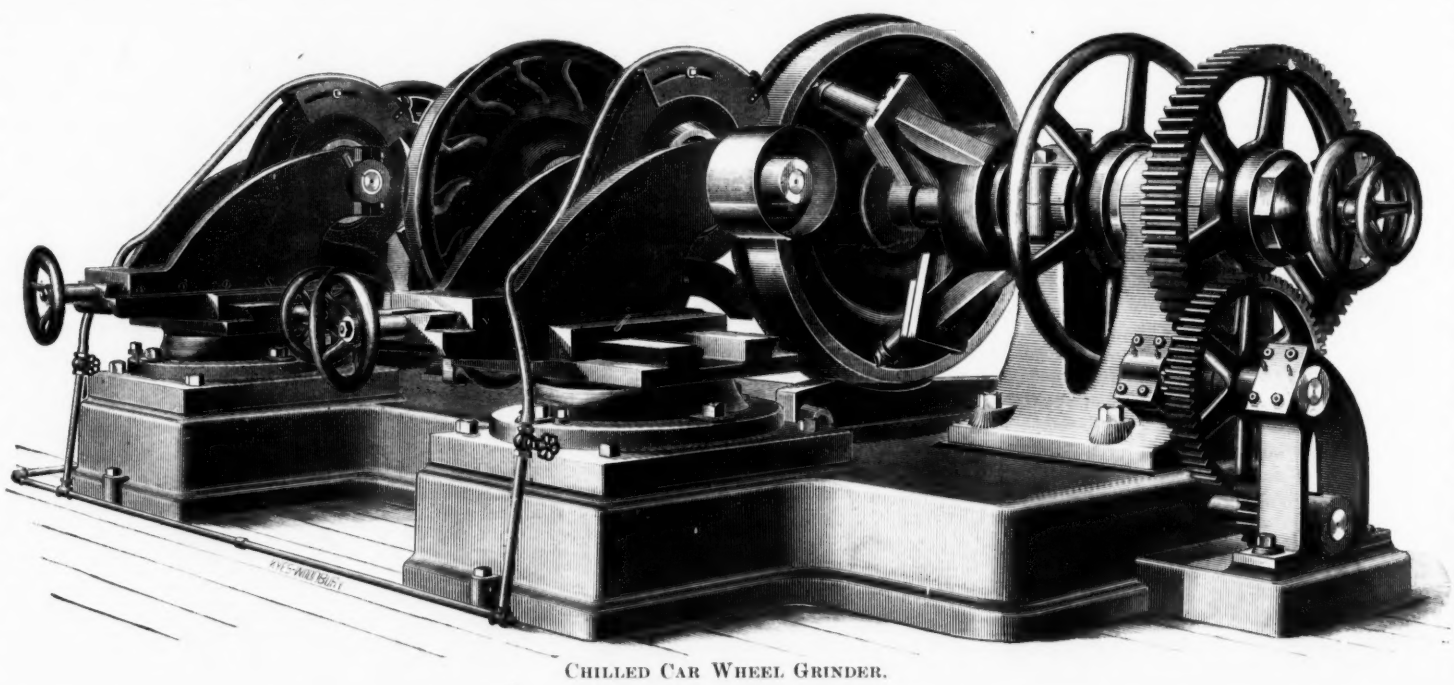
ENTERED AT POST OFFICE, NEW YORK, AS SECOND CLASS MATTER.

Chilled Car Wheel Grinder.

Our illustration on this page is of a new grinding machine for grinding the tread of chilled car or locomotive truck wheels.

The advantages of grinding such wheels are coming to be very well understood, as experience has shown that wheels made true and smooth in this way are capable of giving more mileage than where left as they come from the chill, for the reason that pounding and vibration are reduced, while there is also less liability of flattening them by slipping with the brakes, because there are no high places on the tread of the wheel to become wedged in under the the brake shoe, as is the case where a wheel is left rough.

The increased smoothness of running also has a favorable effect upon the durability of journals and machinery generally, as well as upon the track. Wheels which have been flatted by slipping, and which would otherwise be condemned as scrap, can at small expense be ground true again, and when so ground will often give more mileage than can be got out of rough wheels during their entire life.



CHILLED CAR WHEEL GRINDER.

In grinding wheels some difficulties have presented themselves, which are not encountered in other classes of work done by grinding, and in designing this machine it has been an object to overcome these difficulties so far as possible. In the first place, the work is heavy and requires usually some special rigging to enable it to be handled readily, and unless this can be done easily the time consumed in placing wheels in the machine to be ground and removing them after grinding becomes too large a proportion of the total time spent upon the work.

Then in many cases it was found that machines used for this purpose were too light and allowed too much springing away of the wheels from the work. Reference to the engraving will show that the machine is sufficiently heavy and so designed as to overcome this difficulty, the machine weighing about seven tons.

The machine consists of a heavy bed-plate located even with the floor, upon which two head-stocks are firmly secured, one at each end of the plate. Each of these heads is provided with three spindles, which work one inside of another, and the spindles are simultaneously revolved by powerful gearing and a shaft running under the bed-plate. The inside spindles carry the centers and support the wheels. They are horizontally adjustable to any length of axle by the hand-wheels at the back of the heads. The second spindles carry the gear wheels, and impart the revolving motion to the inside as well as the outside spindles by means of keys. The outside spindles which carry the clamping arrangement are horizontally adjustable by the large hand-wheels located in the middle of the heads. The clamping heads are provided with three arms having radially adjustable yielding contact points, which are forced against the wheels by the large hand-wheels, and take hold at the under side of the rims. The contact points are made of tool steel, shaped in two edges, and conform themselves to any irregularities in the shape of the wheels. By these contact points the wheels are driven, and as they are capable of adjustment to the wheel independently of the spindles, which carry the centers and support the wheels and axle in place, these latter spindles can be so adjusted as to bring the wheels into proper position relatively to the grinding wheels, regardless of the distance the axle projects outside the wheels, or even if there is no such projection. The contact points are also readily adjusted radially for different sized wheels and as the driving is by both wheels and near the tread, it is found that the motion imparted to them is steady and sufficiently powerful to enable the heaviest grinding to be done where circumstances call for it, without vibration or jar.

On one side of the bed-plate are placed the heads which support the grinding wheels. These heads have two slides for regulating the cut, and pains have been taken to so design and proportion the heads as to do away with all liability of springing.

A short track is located under the car wheels, and is provided with a cam arrangement, by means of which the car wheels and axles are lifted up to the center of the spindles and held there until secured, when the cams are lowered, and the wheels will swing free of the rails. By this arrangement the man that operates the machine is enabled to exchange wheels in three or four minutes.

A tank is formed in the base of the machine for water, from whence it is taken by a centrifugal pump, and by suitable piping carried to the wheels, valves being put in for regulating the flow. The pump has a capacity to furnish an abundant supply of water, as it is found advantageous to apply water freely, the wheels cutting better and without heating the work. An adjustable hood nearly surrounds the wheels and prevents the water flying, and the top of the bed slopes toward the center, so that the water flows to the tank to be used again.

The machine will grind from six to eight pairs of new wheels, or five to seven pairs of old wheels in ten hours, at a total cost of 24 to 28 cents per wheel, including labor, cost of wheels, oil, and all other items of expense, and the experience of the Pennsylvania and other roads with ground wheels shows that such grinding pays well, especially for passenger service. The machine is made by the Springfield Emery Wheel Mfg. Co., Bridgeport, Conn.

Grate Surface, Smoke-stacks and Exhaust Nozzles for Locomotives.

The grate surface, smoke-stack and exhaust nozzles of a locomotive bear a close relation to each other, and for securing economy of fuel their relative sizes are of great importance.

After the size of cylinder has been decided upon, the design of the boiler comes up for consideration, and the first thing to be determined is its grate surface. Here it may seem that the proper mode of procedure will be to determine the horse-power of the engine, as is often done in stationary and marine engine practice. But the locomotive designer seldom bothers his head about the horse-power of his engine, because for fast running the piston speed and terminal pressure do not vary much; and, therefore, he adopts a certain ratio of grate surface to the piston displacement. This ratio is greater for anthracite than for bituminous coal because hard coal fires are generally shallower than those of soft coal. The depth of the former varies from 6 to 15 inches, according to the quality of this particular kind of coal and the nature of the service of the engine. The depth of the latter varies from 15 to 24 inches. The reason for using different depths of fires for these two kinds of coal is that when bituminous coal is heated in the furnace it parts readily with its hydrocarbons in the form of gas, leaving the solid portion as a spongy, porous mass (coke), or dividing the lumps into a greater number of smaller pieces, thereby allowing the air to get access to the interior of the solid coal.

The anthracite coal, on the contrary, does not break to pieces so readily, if at all, and, therefore, the air can come in contact with the exterior surface of the lumps only. Hence, a freer intermingling of air with this coal is required than with soft coal, and this accounts for the difference in the depths of fires. Again, since both kinds of coal contain nearly the same number of units of heat, in round numbers about 14,000 per pound, and since the depth of hard coal fires is less than that of soft coal, it follows that to evaporate about the same amount of water in both cases, a larger grate surface is required for the former than for the latter. There are also other practical considerations which affect the ratio of the grate surface to piston displacement, and, therefore, we often find a difference in these ratios; but the average practice seems to indicate that for anthracite coal 8½ square feet of grate surface for every cubic foot displaced by one piston during a stroke will be as large a ratio as the design of the engine will admit, and will give good results. We may, therefore, establish the following rule:

Multiply the displacement in cubic feet of one piston during a stroke by 8.5; the product will be the area of the grate in square feet for anthracite coal burning engines.

In this class of engines the fire-box is often placed on top of the frames, and when this is the case there is generally no great difficulty in adopting a grate as large as found by the foregoing rule. But in soft coal burning engines the required depth of fire often compels us to place the fire-box between two driving axles; and since the distance between these, in large engines, is limited by the length of the side rods, there is also imposed upon us a limit to the grate area. Consequently in some large engines the grate area does not exceed 5 square feet per cubic foot of piston displacement; whereas, in small engines, say with cylinders up to 11 inches diameter, the ratio is often 7½ to 1 and sometimes a little more. Here, then, it is seen that practical considerations will often limit the size of grate. But generally the grate area should not be less than 6½ square feet per cubic foot of piston displacement. Adopting this ratio, we may establish the following rule:

Multiply the displacement in feet of one piston during a stroke by 6½; the product will be the grate area in square feet for bituminous coal burning engines with cylinders 12 inches in diameter and upwards. For engines with smaller cylinders the ratio of grate area to piston displacement should be 7½ to 1, or even more, if the design of the engine will admit this proportion.

The grate areas in the following table have been found by the foregoing rules, and agree very closely with the average practice:

TABLE I.

GRATE AREAS.

COLUMN I.	COLUMN II.	COLUMN III.
Size of cylinders in inches.	Grate area for anthracite coal in square inches.	Grate area for bituminous coal in square inches.
12 × 20	1,591.20	1,216.80
13 × 20	1,872.72	1,432.08
14 × 20	2,178.72	1,666.08
15 × 22	2,741.76	2,096.64
16 × 24	3,414.96	2,611.44
17 × 24	3,855.60	2,948.40
18 × 24	4,320.72	3,304.08
19 × 24	4,810.32	3,678.48
20 × 24	5,326.64	4,080.96

There is a great variety of stacks. Their design depends chiefly on the kind of fuel used, and also on the kind of smoke-box to which they are attached. Many stacks are designed to serve as spark arresters, hence the great variety of stacks. We shall consider here only two kinds—the diamond stack and the tapered stack. The former contains a deflector or cone and netting at the top, for the purpose of arresting the sparks; it is, therefore, generally used on short smoke-boxes. The latter is a plain pipe a little larger in diameter at the top than near the bottom; it is generally used on extension fronts or smoke-boxes which contain a netting for arresting the sparks. Locomotive stacks cannot be made high enough to create a natural draught, consequently other means for obtaining the required draught must be provided. This is accomplished by the action of the exhaust steam, which may be described briefly as follows: As the exhaust steam passes through the stack it acts similar to a piston in a cylinder, taking with it a portion of the gases in the smoke-box. The blasts which occur in quick succession create a partial vacuum in the smoke-box and furnace, causing the external pressure of the atmosphere to force air through the openings in the grate and through the fuel, from whence the air and products of combustion are drawn through the tubes, and finally ejected through the smoke-stack into the outer air. From the foregoing it will be seen that the stack alone—or the blast without the stack—cannot create the required draught, but the two must act in conjunction. It may, therefore, be reasonably assumed that the stack should have a definite size, but on this matter engineers do not seem to agree. Our experience seems to indicate, and this is partly confirmed by practice, that the internal area of the smallest cross-section of the stack should be $\frac{1}{17}$ of the area of the grate in soft coal burning engines. If we adopt the grate area given in Column 3, Table 1, and divide it by 17, we obtain the internal area of the smallest cross-section of the stack. In this way we have found the areas of stacks and their corresponding diameters given in the following table.

TABLE II.

DIAMETERS OF STACKS.

COLUMN I.	COLUMN II.	COLUMN III.
Size of cylinders in inches.	Smallest cross-sectional area of stack in square inches.	Diameter of stacks in inches.
12 × 20	71.57	9⅜
13 × 20	84.24	10½
14 × 20	98.00	11¾
15 × 22	123.33	12⅝
16 × 24	153.61	14
17 × 24	173.43	15
18 × 24	194.35	15¾
19 × 24	216.38	16½
20 × 24	240.05	17⅛

We have seen that in anthracite coal burning engines the grate surface is greater than in soft coal burners, and therefore it would seem that the diameters of the stacks for this class of engines should also be greater than those given in the table. But since lighter fires are carried in hard coal burning engines, the given diameters of stacks need not be changed for the given size of cylinders.

There are two kinds of exhaust nozzles used, the double and the single one, but which of these will give the best results is another matter on which engineers do not agree. The advocates of the double nozzle claim that by its use the exhaust steam from one cylinder cannot possibly interfere with the exhaust of the other one, and therefore it cannot increase the back pressure in one or the other cylinder, as may occur with the single exhaust nozzle. On the other hand, the advocates of the single exhaust pipe claim, and justly so, that the blast should be concentric with the stack, and this can only be obtained with the single pipe. They also deny that with its use a part of the exhaust steam can be discharged from one cylinder into the other, and in order to prove their assertion have produced indicator cards taken with each kind of nozzle, and these cards do not show any appreciable difference in the back pressure. Our choice is the single exhaust nozzle; it will give good results if properly designed, and the cost of making it and keeping it in repair is comparatively small.

In extension smoke-boxes the exhaust pipes extend to within a short distance from the top of smoke-box; hence the bridge in these pipes can be made comparatively high, and the danger, if any, of exhausting from one cylinder into the other much reduced. It is for this reason that for extension boxes the single exhaust pipe is the favorite one.

The area of the orifices in the exhaust nozzles depends on the quantity and quality of the coal burnt, size of cylinder, construction of stack, and the condition of the outer atmosphere. It is therefore impossible to give rules for computing the exact diameter of the orifices. All that can be done is to give a rule by which an approximate diameter can be found and used as a basis from which the exhaust pipe can be designed. The exact diameter of orifice can only be found by actual trial, and then such a diameter should be adopted as will give the greatest economy in fuel. We have just stated that among the things which affect the size of the orifice is the quantity of coal burnt and the size of cylinder. These affect the size of the nozzle more than anything else. Now when the grate surface bears a certain ratio to the cylinder we can at once proportion the size of nozzle to the grate, and leave the cylinder out of consideration. Our experience leads us to believe that the area of each orifice in a double exhaust nozzle should be equal to $\frac{1}{100}$ part of the grate surface.

For single nozzles the area of the orifice should be $\frac{1}{200}$ of the grate surface. These ratios have been used in finding the diameters of the nozzles given in the following table. And comparing these with those in regular service, it will be found that they agree very closely. The same sizes of nozzles are often used for either hard or soft coal burners.

TABLE III.

DIAMETERS OF EXHAUST ORIFICES.

COLUMN I.	COLUMN II.	COLUMN III.
	Double Nozzles.	Single Nozzles.
Diameter of cylinders in inches.	Diameter of orifices in inches.	Diameter of orifices in inches.
12 × 20	2	2 13/16
13 × 20	2⅛	3
14 × 20	2 5/16	3¼
15 × 22	2 5/16	3 1/16
16 × 24	2⅜	4 1/16
17 × 24	3 1/16	4 5/16
18 × 24	3¼	4⅝
19 × 24	3 7/16	4 13/16
20 × 24	3⅝	5 1/16

The sizes of nozzles given in the table are more suitable for tapered stack than for diamond stacks, because there is no obstruction to the escape of gases in the former; in the latter there are the cone and netting which reduce the velocity of the gases, consequently for diamond stacks somewhat smaller nozzles than given in the table will be required. It should also be remembered that these sizes are for grate surfaces whose ratio to piston displacement is 6½ to 1, and since in large engines a smaller ratio must sometimes be adopted, the exhaust nozzles in such cases must also be somewhat reduced.

Hardening Steel.

A short time ago we received an inquiry regarding the practicability of heating tools for hardening at such a heat as to give at the first quenching the proper degree of hardness without the necessity for subsequently drawing the temper. The concern from which the inquiry came was about to start in the manufacture of a line of small tools requiring to be tempered, and wished to ascertain what had been done in this line.

Knowing that the Crescent Steel Co. recommended that their steel be hardened in this way, we addressed a letter to Mr. I. H. Patriarche, their New York representative, and a man who has made, and is still making a study of the steel question, and received from him the following reply:

Yours of the 10th inst. is received, and in reply, would say that I cannot give the names of any shops where it is the practice to harden and use tools without drawing the temper, except in our own works.

Where hard metal is to be cut, we recommend this to be done, as the greatest hardness and toughness combined, of which any steel is capable, are attained in this way and no other. There are many tools where it would hardly be safe to do this, but in all lathe and planing tools it is easily done, and the increase in work done by such tools, properly hardened, would be a revelation to most mechanics. This, however, requires more careful watching than where tools are hardened and drawn in the usual way, and few toolsmiths will take the trouble necessary. A little practice would enable any toolsmith to accomplish this to a certainty every time, with all his lathe and planer tools, and with many of his dies and drills.

These men so frequently say that they never heat steel above a cherry heat, that when any one mildly suggests that the steel would harden very hard at a lower heat than they used, there is trouble at once. The fact is that in many shops the toolsmith's fire is too near a window where the sun shines in, and what seems to the man working there to be a cherry red heat is actually an orange or even lemon-colored heat in an ordinarily dark place.

I have seen a maker of fine surgical instruments, whose shop opened on a marble yard, crack tool after tool, and declare he never heated any over a low, red heat, but the reflection of light from the marble slabs in this yard, with the sun shining on them, was such that the man was actually roasting the steel and did not know it. When he put a curtain on the window near his forge, his trouble was over, and there was no further complaint of the steel, for he really was a careful, good workman, though this matter of light had never occurred to him.

So many things qualify the wisdom of recommending a man to harden his tools without drawing them, that we are cautious about it; but beyond a doubt, any good cutting tool hardened at a refining heat will do at least double the work of another tool that is hardened in the ordinary manner and the temper drawn.

The practice of testing a piece of steel by hardening at different heats, cooling in water, and then breaking the piece to observe the grain, will teach any tool maker a great deal about the effect of heat on the grain of the metal.

We feel quite confident that this letter contains information and suggestions regarding the working of steel which would prove invaluable to many steel workers, if they would simply throw away all prejudice in the matter, and give this method a thorough and fair trial.

Those who evidently know most about steel, and have the best success in working it, are most ready to admit that there is yet much to learn regarding the matter, and no matter how good a workman a man may be, he is the better one if he be ready to profit by the experience, and act upon the suggestions of others engaged in similar work.

We know that the method of hardening without drawing looks difficult, and to a certain extent it is difficult, but many of the most valuable achievements are difficult. It is the work of those who lead and excel to overcome the difficulties, and the writer can say, from his own observation and experience, that many of the difficulties connected with this matter are more easily overcome than would at first appear to be the case, and the fact that hardening is done in this way by toolsmiths using the ordinary appliances, such as every shop possesses, ought to be sufficient to inspire every steel worker with a determination to do it himself, or know the reason for his failure.

The improvement in steel, spoken of by Mr. Patriarche as the result of this method of hardening, is not a mere theory, but an actual fact demonstrated by extended experience. Is not such a result worth some trouble and pains in attaining?

For such tools as twist-drills, reamers, taps, dies, etc., we are not aware that this method of tempering has been tried. It seems more difficult to apply it to such tools, but we believe it is worth a trial where they are made in quantities, and venture to suggest the following method of procedure:

Use a lead bath, and arrange things so that it can be kept at practically a uniform temperature. This temperature should be above that of the tool at the moment of quenching; how much above would have to be determined by trial. Heat the tool by immersion in the lead a length of time which can be exactly determined and known, and quench in brine containing a fixed percentage of salt, and kept as nearly as possible at a uniform temperature. It would be better also if the tools were at a known and uniform temperature before being put into the bath, which might be secured by immersion for some length of time in a sand bath kept at an even heat and tested by thermometer.

It would probably be necessary to vary the temperature of the lead bath, or the time of immersion in it, for each different tool; but, where made in large numbers, this would be no trouble after experiment had shown the proper conditions for each. Where the business is sufficiently extensive it might be worth while to arrange to immerse the tools in the lead by mechanism, which would secure absolutely uniform time of immersion, as, the bath being hotter than the required temperature of the tool, the duration of immersion would be of vital importance.

If the bath were to be kept at no higher temperature than required for the tool, the latter would have to be immersed too long, either for economy of operation, or for the good of the steel, which, contrary to the generally accepted belief, can be injured by long immersion in a lead bath not sufficiently hot to burn it. It is not probable, however, that it would be practicable to have the temperature of the bath very much higher than that required for the tools, because, when this is the case, the tendency is to overheat corners and thin portions of the tools before the heavier parts become sufficiently heated to harden.

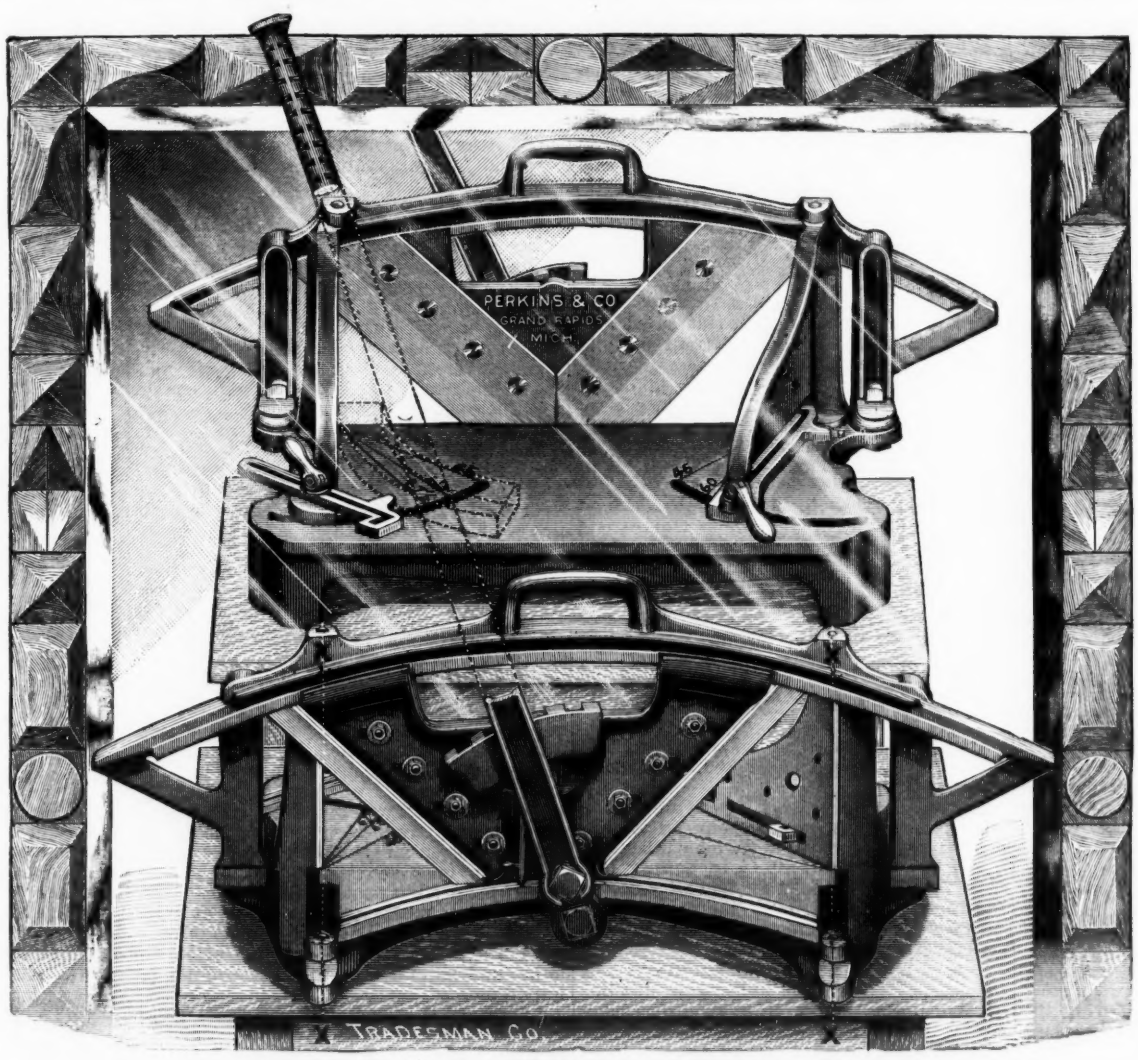
Of course there will be some difficulties encountered in arranging a plant to harden in this way, but if successful it would insure that each tool received precisely the same treatment in every respect, and the treatment, too, which experience has shown will give the best possible results. We believe the experiment is worth trying at least, and would be glad if some of our readers who are so situated as to be able to make a trial of it would do so, and let us know the outcome of it.

Of course, if absolutely uniform treatment were secured in this way then the success of the scheme would depend next upon uniform steel, which the makers now claim to furnish, and insist that their methods of manufacture are such that no difference can possibly exist between different lots of steel intended to be alike. We know that steel workers deny this, and claim that the steel must vary, because different results are obtained with what appears to be the same treatment. But who can read Mr. Patriarche's letter and doubt that it is easy to give steel quite different treatment at different times, and not be aware of it, even when considerable pains are taken? It would be interesting to know, for instance, how much hotter steel is heated on bright, clear days than on dark and cloudy days. There is endless dispute and friction between

steel makers and steel users about the quality of steel, which, we think, would be considerably lessened by so far as possible reducing things to a system which will insure uniform treatment.

The Mirror in Illustrating Machinery.

The accompanying engraving is intended to show what can be done in the way of illustrating small and medium sized machinery by the aid of a mirror. The machine (which in this case is Perkins & Co.'s draw stroke trimmer) is placed upon a table in front of a mirror, and a photograph taken from a point sufficiently above the machine to include in the view the reflection in the mirror, which of course shows the opposite side of the machine, and thus two views are simultaneously obtained, one showing the front, while the other shows the back of the machine. Such illustrations have been made before, as those of our readers who look over the advertising pages of the magazines know, but so far as we are aware this is the first application of the principle to the illustration of machinery. We think it may be found useful in many cases, either in showing a second view of an entire machine, or some part of it which is not made clear by a single view. In this case it so happened that the machine chosen for illustration is of such a nature that the work done by it could also be shown, as the frame of the glass is made of blocks trimmed to shape by the machine. By previous illustrations of similar machinery our readers are familiar with trimming machines, and the construction of Messrs. Perkins & Co.'s machine will be readily understood from the engraving.



THE MIRROR IN ILLUSTRATING MACHINERY.

The Cost of German Labor.

A correspondent of the New York *Evening Post*, in a recent communication to that paper, throws some additional light upon a question in which our readers are interested, and that is as to the relative cost of work done by highly paid or low paid labor.

After referring to the published statistics bearing upon the question, he gives it as his opinion that, "as industry is organized to-day, the highest paid labor is the cheapest the world over." * * *

"Any traveler in this country can find illustrative material in plenty if he will open his eyes. Let him take the public service. The Munich post-office employs twice as many men as the Boston office, and for much less than half the work. The Royal Library, with a greater staff of servants, does not handle one-tenth part of the books circulated by the Boston institution. It is the same in public works. They were in haste to pave one of the chief thoroughfares of this city; they got enough workmen to stumble over one another's heels, but they could not do more than a block a week, and when one saw their tools one did not wonder at it. This work cost as much for the labor as the same work would with us. If your curiosity leads you into the field or the factory, if you watch the masons or carpenters at work, you will find everywhere the same conditions. I was told some time ago by a gentleman from Lynn that to his personal knowledge a shoemaker there, having a son with remarkable musical talent, had gone with him to Dresden and undertaken to do piece-work for a shoe factory there. His own statement was that he could make more money at German prices than at home. He worked with better tools, with better brains, and with better hands, too, for he was better fed.

When the engines of one of our new warships develops a trifling structural weakness in some part, we are sure to hear about it in every daily paper in the country. So we may assume that we know of all the cases of giving away that occur. And it is astonishing how few do occur, considering that in about every case the engine is in a certain sense an experiment. So considered, the results compare very favorably indeed with practice in constructing large engines of any type.

Condition and Prospect of the Machinery Business.

LETTERS FROM PROMINENT ESTABLISHMENTS TO THE "AMERICAN MACHINIST."

The Link-belt Engineering Co. (Engineers and Machinists, Approved Appliances for handling material in bulk or package), Nicetown, Philadelphia, write us:

The volume of our business during 1890 has been largely in excess of the previous year's total, and is satisfactory in other respects. The outlook for the coming year is very promising, and we have prepared for expected increase by large additions to our plant and equipment. We have known no dull season during the past twelve months. We do not note any material changes in prices of labor. The materials we employ, iron and steel, have advanced somewhat, but not to a disturbing extent. On the whole we report satisfaction in the actual results of the past, and in the outlook for the immediate future.

E. Gould & Eberhardt (Machine Tools), Newark, N. J., write us:

Our business for the year 1890 has been very satisfactory in many respects. We have shipped 25 per cent. more than we did in 1889. We have added a large number to our force, and they have been at work full time throughout the entire year. We have made an addition to our buildings, and have added several new iron-working machines. These additions to our equipment have enabled us to supply the demand for our tools within a reasonable time. Our trade has been well distributed, coming from all parts of the United States, and from the principal centers in foreign countries where improved automatic iron-working machinery is used. We have added a number of important improved tools to our already large list of machines during the year.

There has been a greater advance in the price of labor and raw material than in the finished product. To overcome this, we have been making our machines in large quantities with improved tools and equipment, endeavoring to meet this discrepancy by reducing the cost in this manner.

We still have a large number of unfilled orders on our books, and the prospect for additional business during the coming year is fair, although we do not attempt to predict the results of the speculations indulged in, in the financial centers, which seem again rampant.

New Haven Manufacturing Company (Machine Tools), New Haven, Conn., write us:

Our business up to this time this year has been all that could be desired. We have been kept fully employed constantly to the full extent of all our facilities, and at present have a large amount of orders on hand, and are driving to our fullest capacity, and were it not for the present financial stringency, which we fear must affect business to some extent, we should consider the outlook for the future uncommonly bright and promising. We have made some additions to our works during the past year and added quite a number of new tools, and expect to be able to keep them all fully employed during the coming year.

Curtis & Curtis (Pipe-cutting and Threading Machines), Bridgeport, Conn., write us:

We are thankful for a most successful business year. Our pipe-cutting and threading machines seem to have grown in favor with the trade greatly, as shown by the ready sales. Not one month during the year have our sales and shipments failed to exceed same month of last year, and our total shipments for 1890 will exceed those of 1889 about 25 per cent. We have brought out quite a number of new sizes in our style of pipe-threading machines, as well as having greatly improved them in many respects. The prospects for next year are of the best, and we look forward to a still further growth in the year to come.

P. Blaisdell & Co. (Machine Tools), Worcester, Mass., write us:

Our business for the year now ending has been very satisfactory. We have been obliged to enlarge our works, and to-day have one-third more men in our employ than in 1888. We have been from two to three months behind in filling our orders, and now have orders on our books that we cannot fill in less than three months. While we have improved our facilities for getting out work, we have also added to the cost of production. All of our machinery has been changed in design, made heavier, all sliding surfaces are scraped to a fit, all machines are tested thoroughly before leaving the works, and are fully warranted to be first-class in every respect. We take particular pains to have every lathe turn perfectly straight, square up true, and all live centers to run perfect. We also pay particular attention to the leading screws, having them cut from screws made by Messrs. Pratt & Whitney and the Brown & Sharpe Manufacturing Co. for this purpose.

Prices of labor have advanced about ten per cent., also the cost of material that enters into the construction of our machines. There has been a slight advance in our selling prices owing to the above advance. The present outlook for the next year is good, and the prospects for a little more margin on our product is very encouraging.

Cleveland Twist Drill Company (Twist Drills, Reamers, etc.), Cleveland, Ohio, write us:

We have had a very prosperous year in our business—our orders for the year averaging more than the output of the factory.

We have since the first of May doubled our capacity in the turning department, and added to our floor space considerably, and will after the first of the year make an addition to our factory of a brick building 150x50 feet, two stories high. We will be in shape to fill it with machinery almost immediately, as we are building a large number of special machines, designed expressly for our work.

Collections during the year have been very good indeed—just at present we notice a slight stringency in this direction, but see no reason why business for 1891 should not be fully up to the average for the past five years.

The Hoggson & Pettis Manufacturing Company (Lathe Chucks, Bank Punches, Belt Clamps, Typewriters, Cutting Dies, Special Machinery, etc.), New Haven, Conn., write us:

Replying to yours of 10th, would say the past year has been the busiest one we ever knew. We had considerably exceeded our business of the year 1889 in the eleven months ending December 1, 1890, and with the orders on hand the present year [1890] bids fair to show an increase over last of between fifteen and twenty per cent. Our chuck department has been unusually crowded, and we have found it impossible to keep a stock of goods ahead.

An addition to our works of a forge shop, 40x40 feet, made during the early fall, which we have fitted with the latest appliances, will enable us to get out our forgings with less delay; and the new machinery we are adding, and which we expect to add, will enable us to keep up with the demand for our goods, which seems to be increasing. Our new reversible jaw chuck is giving the best of satisfaction everywhere. Labor and materials remain very nearly the same as last year.

Lackawanna Lubricating Company (Cylinder Lubricators, Grease Cups, Shaft Governor Bearings and Loose Pulleys), Scranton, Pa., write us:

We have to report that the "Lackawanna" grease cups and cylinder lubricators are steadily pushing to the front and rapidly gaining in favor with well-informed engineers all over the country. During the past year we have not only held on to our old customers, but have added a large number of new ones to the list.

The outlook for future business is very good, and we confidently expect to sell a great many of our devices during 1891. Backed up by another year's experience, with improvements made in both cups and compounds, and carrying constantly a large stock on hand, we are in better shape than ever before to meet the wants of our customers promptly and satisfactorily.

We desire to state also that we consider our advertisement in the AMERICAN MACHINIST as a first-class investment. It has brought us many inquiries from home and abroad.

Henry Warden (Boilers, Tanks, Girders, Strong's Locomotive Boiler, Manning Vertical Boiler, Atkinson's Cycle Gas Engine, Atkinson's Feed-water Heaters, the Cycle Filter), Germantown Junction, Philadelphia, writes us:

During the past year we have been very busy in our boiler shop executing orders, and have built more boilers than in any previous year, and have a fair amount of work ahead for next year. Our "Cycle" gas engine has attracted a great deal of attention, and we expect during the coming year to get it, as well as our feed-water heater and other specialties, well introduced.

Joseph Dixon Crucible Company (Graphite, Plumbago, Black Lead, Fine Office and Drawing Pencils, Black Lead Crucibles, Carburet of Iron Stove Polish, Graphite Grease and Lubricants), Jersey City, N. J., write us :

To the Dixon Crucible Co. the year 1890, as we predicted twelve months ago, has brought a greater volume of business than for any previous year. While sales have increased prices have also declined, which means proportionately a greater quantity of goods. Our output has taxed all the facilities we have, and in 1891 we must tear down and build greater. Competition has never been so active. Some of it before never was so foolish. Cut prices, when they approach and go below cost, mean lack of business brains. In such competitions cut prices are the weak resources of the incompetent. The outlook for 1891 we think is good, except as it may be qualified by timidity born of the present financial troubles. Successful business every year ceases more and more to be a walk-over, and the Darwinian law, the "survival of the fittest," is to be the law of the future in business as well as in nature.

H. W. Johns Manufacturing Co. (Liquid Paints, Colors, Roofing, Boiler Coverings, Steam Packing, etc.), New York, write us:

Business for the year 1890 has been exceptionally good.

Have added one brick building 140 x 60 to our plant, beside some additions to old buildings.

Prices on some raw and manufactured goods have advanced to a slight extent, but on majority of goods they have remained stationary. No change of moment in prices of labor.

Can make no predictions regarding 1891, in the view of the present financial situation.

Knowles Steam Pump Works, New York, write us:

We have nothing special to say in regard to our business. It keeps up, is fully equal to its usual standard, and is moving pleasantly.

Hugo Bilgram (Engineer and Machinist, Bevel Gears Cut Theoretically Correct, Maker of Special Machinery, Wire Book Sewing Machines), Philadelphia, writes us :

During the year (current) I have been fairly employed. In the gear cutting department, especially in the planing of bevel gears, I find that the demand is steadily increasing, and accordingly I am continuing to provide increased facilities for the prompt execution of work in this line.

H. Bickford (Boring and Turning Mills), Lake Village, N. H., writes us :

With capacity increased a year ago have been unable to fill my orders, and the indications are that it will be necessary to make another increase in capacity. Prices unchanged.

T. R. Almond (Almond Drill Chuck and Almond Patent Coupling), Brooklyn, N. Y., writes us :

My business has increased fifty per cent. during the past year. I have received more orders for my angular coupling during the last three months than for any previous twelve months. Our South American and European visitors have had something to do with this, and I am of opinion that, in spite of Mr. McKinley, we shall be greatly benefited by the good impression created in the minds of our foreign colaborers. Wishing you the success which your valuable paper so well merits.

Volney W. Mason & Co. (Patent Friction Pulleys, Friction Clutches for Connecting Shafting, Hoisting Machinery and Elevators), Providence, R. I., writes us :

The past year has been a busy one with us, making our usual quota of friction pulleys, also friction clutches for coupling shafting, and especially our new patent balanced segment friction pulleys. Our orders also from many new customers from Maine to California.

Also have made many of our new patent quick-speed whip hoists for rapid hoisting and lowering of goods, which for simplicity and efficiency are unequaled, being first designed by us for the N. Y. C. & H. R. R. R. new hay sheds at Thirty-third street and Eleventh avenue (Hudson River), where we furnished sixty-one hoists on a single line shafting about 600 feet in length (longest in the world).

Have also just completed a second plant hoists of fifty for new hay depot of Lowell M. Palmer at his new docks, North Ninth street, Brooklyn, N. Y., and shafting 450 feet long. Have also applied them for other purposes, hoisting by electric motors, lumber, merchandise, bales goods, etc., in Providence, Boston and other places.

P. S.—We shall increase our advertising with you in 1891.

Miner & Peck Manufacturing Company (Peck's Patent Drop Press and Drop Lifter, Steel and Iron Drop Forgings), New Haven, Conn., write us :

Since the present firm succeeded that of Beecher & Peck in May last we have had a steadily increasing run of trade, until now we are pushed to our utmost capacity to fill our orders. We have added to our facilities, and expect to soon further increase them. Our outlook is very pleasing, and by pushing our business with energy expect to do a much larger business during 1891 than ever before. We have recently added some new designs to our already large line of Peck drop presses.

The Appleton Manufacturing Company (Emery Grinding Machines, Sewing Machines, etc.), Philadelphia, Pa., write us that their business has kept them running full handed throughout the year with a marked increase the last quarter over the corresponding period of the previous year, due, in a large part, to recent important additions they have made to their line, notably their universal grinding machine, to which we notice they devote considerable space in a new catalogue they have just issued.

Timothy Kieley (Steam Traps, Valves, etc.), New York, writes us:

I am too busy filling orders to say hardly anything with regard to the condition of trade in my line, only this—that business is booming.

Capitol Manufacturing Company (Bolt Threading Machinery, etc.), Chicago, Ill., write us:

We are pleased to say that since we wrote you last year our business has increased very largely. We have removed from our old factory into new and commodious quarters, and the volume of our business on all of our specialties is almost seventy-five per cent. greater than it was prior to the last report.

We have added a number of other articles to the line of our manufacture, and all of them have met with good success. We feel satisfied that we will be in a position next year to write you of a still larger increase in our business. The prospects for the coming year are certainly very promising.

McGrath & Collins (Manufacturers of McGrath's Patented Yielding or Rigid Journal Bearing, Grinding, Polishing and Buffing Machinery), Cohoes, N. Y., write us:

Our grinding machinery is fast displacing the old style of rigid and suspended bearing machines.

We have now 100 machines in operation. All new concerns who are obliged to purchase new grinders will have none other.

We have now a contract to supply two large foundries in the West, and we received the order on the merits of the machine, we beating all other competitors both as to its superiority and price.

We owe the AMERICAN MACHINIST our thanks for its assistance in bringing this line of machinery before the manufacturing public.

The indications are that our orders will be very heavy for the year 1891.

W. P. Davis (Drills and Key Seaters, Iron-working Machinery, Engines and Boilers), Rochester, N. Y., writes us :

The volume of my business has been at least double that of any previous year. My machines have been taken as fast as finished, and at present writing I have orders enough ahead with our regular work to keep running steadily for at least six months. In the past six months I have brought out several new machines, and I now build a complete line of drills from 12″ to 42″, embracing all the latest features in the various styles of upright drills, from my semi-sensitive drill to large drills that can be used for boring or tapping heavy work, etc. My call for key seaters is about the same as usual. We make them in lots of fifty, and they are usually all sold, or nearly so, by the time we get the next lot finished. I continue to make a special push on 20″ drills, and build all tools of this kind in large lots. In this manner I am able to bring out a better tool for the money than any one that only builds a few at a time. My business is gradually changing, and I am also changing my line of advertising, as I find advertising list of new and second-hand machinery in the various trade journals adds very much to our sales. We keep a very large stock of all kinds of machine tools, engines, boilers and supplies, and our trade now reaches all over the United States. I find there is a large call for first-class second-hand machinery of all kinds, and our past experience in the manufacturing is of great help to us in buying this class of machinery, and I find there is a ready market for nearly anything in this line that is in first-class order, and I avoid as much as possible handling any tools of inferior quality.

William Lowe (Boilers, Feed-water Heaters and Plate Metal Work), Bridgeport, Conn., writes us :

Our business for this year has required all our facilities, and we find ourselves about a month behind with our work, although we have done all we could, and run nights some to keep work forward, so that we could do all possible in the time we were obliged to promise it. Our facilities have not been increased, and as they are generally fully employed by our regular patrons, we cannot take orders from many new ones, and have had to refuse many good orders, but took some, which is the cause of our being behind with the work. In regard to prices, the same crazy competition and increased facilities keeps the prices too low; a number of shops have increased their facilities, and several new ones have started in, all of which tends to keep prices unremunerative. One of the largest boiler works in the West reported that they had done a business of $650,000 last year, and realized only 4½ per cent. This tells the whole story. Why did they not do $300,000, and make 10 per cent? They would have been as well off, and other shops would have got 10 per cent. on the remainder, and all have been so much better off. The fact is (as I have heretofore stated) the facilities are increased too rapidly, and in this way the buyer gets the advantage of low and unremunerative prices. We have done a greter variety of work this than last year, and a larger proportionate amount of our specialties. The Lowe boiler and the Lowe feed-water heater and purifier, of which we have made larger plants of the latter than ever before, and some large plants of the former, and some for parties who have been watching their results for over twenty years, and now conclude to adopt it, which is very flattering, and strong evidence in their favor. In regard to the prospects for the coming year we have many orders which will run into next year, and orders are now coming in for boilers and other work which will give next year a good start, and as to prices and business for the coming year we feel that they will both be better if not spoiled by the pernicious disposition of the manufacturers to do six months' work in three, to meet the unreasonable and unnecessary demands of the buyers, who think they must have it, and at a lower price than it can be afforded.

L. S. Starrett (Fine Mechanical Tools), Athol, Mass., writes us :

I am pleased to say the past year has been a very busy one for me. The many flattering letters I have received from mechanics in love with my make of tools, together with more orders than we can keep up with, is very encouraging. I have recently added to my plant several machines of the best make, which will increase my productions; among them are an additional graduating machine, three screw machines (two of them automatic), three Pratt & Whitney power milling machines, a large surface grinding machine, lathe, and several other machines of minor importance.

I have about seventy-five assistants, some of them working extra hours for the last two months.

Among the additions to my last year's productions are a locomotive guide liner and improved key seat rule, a micrometer surface gauge, depth gauge and an improvement in micrometer calipers.

As to future prospects, I have never seen the time when I did not have enough to do, and expect good business the coming year.

The Meriden Machine Tool Company (Machine Tools and Brass-Working Machinery), Meriden, Conn., write us :

We are well satisfied with our business for 1890. We have lately added new tools that increase our capacity largely, and we are well prepared to meet the increase in business, which, judging from our past year's experience, we think we may reasonably expect.

J. A. Fay & Co. (Wood-working Machinery), Cincinnati, Ohio, write us :

Our orders during the year just closing have been over 15 per cent. larger than for the year previous. We have made quite an addition to our buildings, have purchased a large number of new machines, and our force has been increased to the full capacity of our present plant. The works have run 10 hours per day throughout the entire year, and at the present time we have a large number of unfilled orders on the books. During the year we have added several very important labor-saving machines to our already large list of tools for cutting wood. Our foreign trade has been exceedingly satisfactory, and has steadily increased. We are shipping a large number of our machines to the principal countries of South America and Australia, and what may seem as being a little out of the ordinary, our trade in Great Britain and in Europe has been very much increased since our recent display at the Paris Exposition. During the last few weeks there has been a slight reaction in trade, especially in some lines. We judge, however, from our inquiries, that this is only temporary, and as soon as confidence is established in financial matters that our orders will be as large as they have been during the past year. Prices for our goods have not advanced, although our machines have been very much increased in weight, and are much more expensive to construct than formerly, so far as weight and material are concerned. To a certain extent we have overcome this by the introduction of jigs and templates so at the present time all of the machines that we build in large quantities are interchangeable.

Morse Twist Drill and Machine Company (Twist Drills, Reamers, Cutters, etc.), New Bedford, Mass., write us :

We have been well occupied the past year, and have added extensively to our buildings and machinery. We begin the new year with largely increased facilities for the making of our tools, and anticipate a season of general prosperity.

P. H. & F. M. Roots Co. (Rotary Blowers, Portable Forges, etc.), Connersville, Ind., write us :

The volume of business done by us in the past year has been greater than any other year in the history of our business.

We have a larger number of orders on our books than ever before at this time of the year. The prospects for future business are very good.

The National Machinery Company (Bolt and Nut Machinery, etc.), Tiffin, Ohio, write us :

Our business for 1890 has come out to the high-water mark we set out to reach, and is 20 per cent. over previous and best year. This in the face of great discouragements, showing the necessity of removal to a more business and manufacturing community, which we intend to do in '91, and also enlarge our facilities in every way. Manufacturing the most complete line in our specialty, which we keep extending, we naturally obtain the patronage of the trade, and have furnished many plants for railroads and bolt shops in the year gone by. We look forward to one equally good in 1891.

Bradley & Company (Power Hammers, Reapers, Mowers, Rakes, Wagons, etc.), Syracuse, N. Y., write us :

Our business for 1890 has been very satisfactory indeed. We have sold more Bradley power hammers during the last twelve months than in the same length of time heretofore since we have manufactured them.

We are at the present time adding to our buildings so as to nearly double our capacity, and naturally feel that the prospects for the coming season will warrant this investment.

Aerated Fuel Company, Springfield, Mass., write us :

We are pleased to report a larger volume of business than ever before, and are now crowded with work; the shortage of natural gas has had something to do with our increase of business, and as our system can be applied to furnaces adapted to the use of gas with little change, makes it especially desirable for such localities; we have changed gas furnaces to oil, and had them in operation in less than two weeks.

From glass manufacturers we are having orders much beyond our expectations; in fact, in all lines of metal work the orders are very satisfactory. We have changed glass furnaces from coal to oil, and from gas to oil, without cooling them off, which is of great importance to the manufacturers. The outlook for the coming year is extremely favorable, both at home and abroad, and we are pleased to think that the AMERICAN MACHINIST is responsible for some part of it.

Westcott Chuck Co. (Westcott's Lathe and Drill Chucks), Oneida, N. Y., write us :

The business of 1890 has much exceeded our most sanguine expectations; output doubled and demand steadily increasing; factory running extra time nearly all the year.

Prospect for coming year excellent. Lately introduced a new drill chuck, called "Little Giant Improved '*Double Grip*,'" which is meeting with favor in all countries. No labor troubles here.

The Albany Steam Trap Company (Return Steam Traps, Pumps and Pump Governors, Renewable Seat Stop and Check Valves, Water Filters, etc.), Albany, N. Y., write us:

We have now been in our new shop about one year. We find our facilities for turning out work improved; our output has been about the same as last year, as a whole; in some branches a little improvement over last year. In our duplex filter business there has been a decided increase. Our new automatic arbitrary steam pump and governor combined, for returning condensed water from heating coils supplied with live or exhaust steam, is meeting with favor by engineers and steam users. We pay our labor the same as we have for the several years past. There has been no reduction in the price of our material to speak of, and our prices for our goods have not been changed. Orders have come in fairly for the past few weeks, and our correspondence would lead us to expect a good volume of trade in the year to come.

Keystone Engine and Machine Works, Philadelphia, write us:

We have to report business with us as even better than last year, our steam specialties claiming considerable attention to supply the demand.

Have no reason to complain.

John S. Leng's Son & Co. (Importers of and Dealers in Iron and Steel, Weldless Steel Tube Co.'s Patent Weldless Cold Drawn Steel Tubes, Leng's Improved Lever and Cam Valve, Portable Railway Siphon, Lansdell Patent Steam Siphon Pumps), New York, write us:

Our trade during the past year has been very satisfactory. We notice a considerable increase in orders for some of our specialties, and we consider the outlook for 1891 encouraging.

The Lane and Bodley Co. (Steam Engines and General Machinery), Cincinnati, Ohio, write us:

We have done a large business during the year 1890, and the prospects were very favorable for the next year until the recent financial disaster, which we fear will have its effect on the development of new enterprises during the coming year. But we have been compelled to enlarge and re-arrange our shop to handle satisfactorily the large engine and machinery business which is now, more than ever, called for in the West. This improvement will increase our output and enable us to employ more workmen.

There has been no material change in the price of labor, although first-class help have been able to obtain high prices.

It is necessary to increase shop capacity so as to turn out 50 to 75 per cent. more product with the same expense to make such profits as will properly sustain machine shops in healthy condition.

The Curtis Regulator Co. (Engineering Specialties, Steam Water Pump and Damper Regulators, Traps, Valves, etc.), Boston, Mass., write us:

We have to report a very prosperous year for our goods and business. Orders have poured in upon us from all parts of the country and from foreign parts, and we have been driving to our full capacity, notwithstanding we started in last summer with a very large stock. While the demand for regulators is no less, the call for our valve steam traps and our steam seperators has greatly increased, and our return traps are selling very rapidly. Our sales have been fully 30 per cent. greater than during the last year, and we believe the demand will continue.

The Buffalo Steam Pump Co., Buffalo, N. Y., write us:

We have worked 12 hours per day the larger part of the year. At the present time we have more orders on our books than ever before. The prospects certainly look very bright for the coming year.

The Cincinnati Milling Machine Company (Plain and Universal Milling Machines and Universal Cutter Grinders), Cincinnati, Ohio, write us:

We are pleased to report that our business for 1890 has been good, sales for this year largely exceeding those of 1889. During this year we have brought out a new line of tool room universal milling machine with a number of new features. The new universal cutter and reamer grinder brought out about a year ago has had a very large sale, fourteen of these machines having been sold in England and Germany. During the year we have increased our facilities by the addition of a number of tools, and expect early in the spring to remove into a new and larger building.

Millers Falls Company (Hardware Manufacturers), 93 Reade street, New York, write us:

We are pleased to report a business for the eleven months of 1890 much larger than in any former year. We have added to our plant a two-story brick building 50 x 130 feet, with 300 additional horse-power. The demand for mechanics' tools has been so pressing that we have not brought out many new inventions, but have several in contemplation. We have made a power frame for our hack saws which promises well. It will cut iron or steel from five inches diameter down without any cost, except for blades, which is next to nothing. Future prospects in our business depend largely on the number and extent of new factories which may be built and stocked with tools in the coming year. Like all successful manufacturers, we find it necessary to improve our goods year by year, to maintain our standing in the market. The late tariff bill has not made any change in the cost or selling price of our goods. As fully one-third of our product is exported, we do not feel sure that the tariff helps us, only so far as it may add to the general prosperity of this country.

Palmer, Cunningham & Co., Limited (Mechanics' Supplies, Tools, Pulleys, Hangers, Shafting and Belting), Philadelphia, Pa., write us:

Business has been very good with us the past year, and from present indications we are expecting a much larger trade in 1891. The new indispensable lathe dog which we are just introducing has taken far in excess of our expectations, our orders coming from some of the largest manufacturing concerns in the country without any solicitation on our part.

Giant Key Seater Company, East Saginaw, Mich., write us:

We are pleased to report a rapidly increasing trade in our key seaters, among our recent orders being the following: Marinette Iron Works, Marinette, Wis., one No. 3; Howard Iron Works, Buffalo, N. Y., one No. 3; Gordon Steam Pump Co., Hamilton, Ohio, one No. 1; American Manufacturing Co., St. Paul, Minn., one No. 1; N. Shaw & Co., Eau Claire, Wis., one No. 2; Clark Bros., Belmont, N. Y., one No. 2, with rack cutting attachment.

Jenkins & Lingle (Engineers and Machinists), Bellefonte, Pa., write us:

The first eight months of the current year were all we could ask. We were pushed to our utmost. A large part of our output of coal and ore washing and separating machinery went South. The closing months of the year are very quiet, and with the prospect of a not very busy winter. The financial stringency is being felt in iron circles on which we depend for the class of work named. Power hammers and shears, which we have not pushed to any extent, have been very satisfactory.

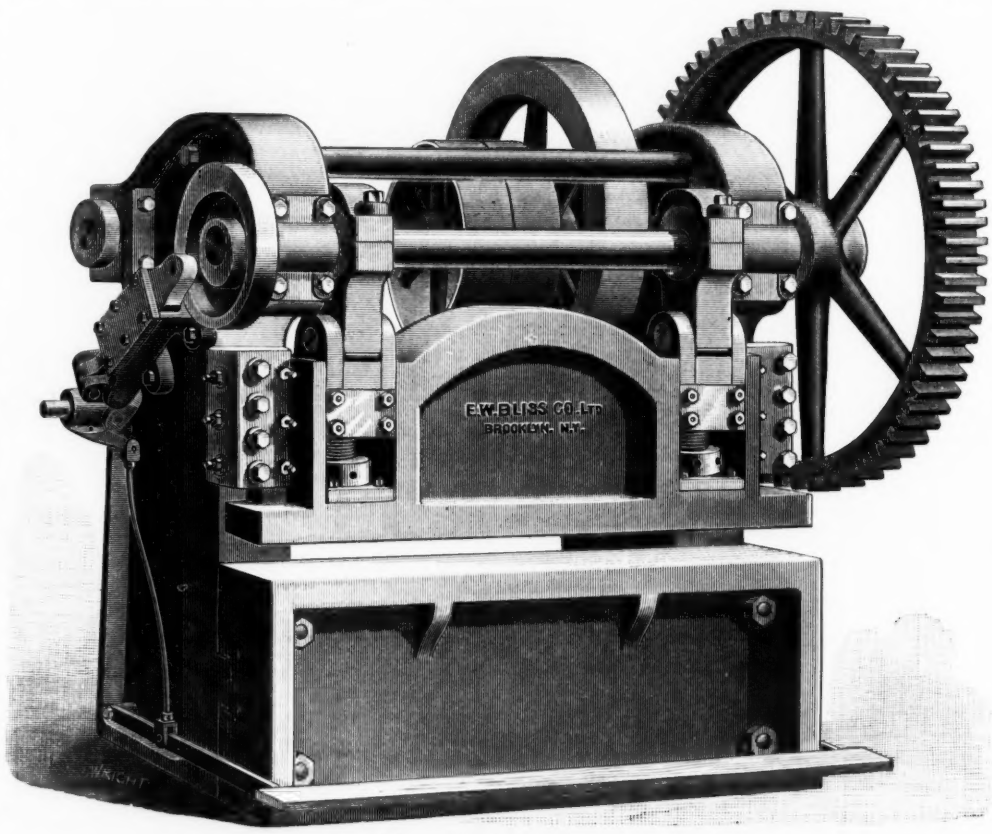
Valley Pump Company (Steam Pumps), Easthampton, Mass., write us:

We have done a very fair business during the year just closing; not as large as it would have been if we accepted all the offers made, limiting the price below where we can go for the class of work we build. Our aim is to do as good work as can be done, and sell it at a fair profit. We let the other fellow have all the customers who do not want our work on these terms, and are perfectly willing he should do a tremendous business.

The Gilkerson Machine Company (Special Machinery), Homer, N. Y., write us:

Our business for the past year shows a marked improvement over any year since we started in eight years ago. Our planer vise seems to be taking in all parts of the country, and we are not able to get much of a stock ahead. We have put in a new engine the past summer and intend to put in some machine tools and special machines for the manufacture of a small high speed engine, about the first of March.

[*Several letters stand over to appear next week.*]



HEAVY RIVETING PRESS.

Heavy Riveting Press.

The press herewith illustrated was designed by the E. W. Bliss Co. (Limited), 17 Adams street, Brooklyn, N. Y., especially for the purpose of riveting reaper knives to the knife-bar, it having the capacity to set 76 $\frac{3}{16}$" rivets at one stroke, making a knife 74" long, thereby greatly cheapening the cost and facilitating the speed of production of these articles. It can be changed for any similar class of work, and made any width or any desired depth of throat. As shown, the length of bed is 74 inches, and width, back and front, 12 inches.

As will be seen by the cut, this press is very strong and substantially built. It weighs, complete, 18,000 pounds.

Under the Thames Again.

If the London County Council follows the advice of Sir Benjamin Baker we shall have underneath the Thames at Blackwall one of the largest tunnels of its kind ever constructed. The plan is similar to that which has been adopted in the construction of the City & South London Electric Railway, but whereas the tunnels of that company are 10 feet in diameter, the one projected at Blackwall has an outside diameter of 27 feet and an inside of 23 feet. The nearest approach to these dimensions are the Hudson River tunnel, which is 20 feet in diameter, and the Sarnia tunnel, which is 21 feet. In September last, Sir Benjamin Baker, under instructions from the County Council, visited these American works, as they present conditions somewhat similar to those which exist at Blackwall, in order to judge of the advisability of adopting the same plans. As the result of his personal study on the spot, the eminent engineer has given it as his opinion that the system is perfectly practicable, and that it should be the one adopted.

Those who have read our descriptions of the South London subway will understand the nature of the work. The tunnel is practically an iron tube built up in segments which are firmly bolted together. The excavation of the ground is effected by means of a shield with sharp cutting edges, which is advanced twenty inches at a time by means of powerful hydraulic presses. While the soil is being taken out the iron segments are built up, and the shield is then advanced another twenty inches. In this way a continuous ring of cast-iron is formed. At first the Hudson River tunnel was driven under the bed of the river without a shield, but in consequence of the inflow of river mud and water, which brought the works to a standstill, the shield was introduced, and the difficulties overcome. In the case of the Sarnia tunnel the heading had at one point to be driven through soft clay, gravel and sand, but by means of the steel shields and compressed air, progress was made, although at a slower rate than when cutting through the clay. About five feet of tunnel per day was what was accomplished in the gravel, while about double that amount was the average in the clay. It is thus possible by this system of driving to work through any sort of soil, as Mr. Greathead also proved when he came to gravel, sand and water, in boring the South London line. At Blackwall there would be no mud, the soil being clay, gravel and sand, so that the conditions would be more favorable on the Thames than on the Hudson. At least eight feet of material would remain between the bottom of the river and the top of the tunnel.

Unlike the South London tunnel, it is proposed to give the one at Blackwall a lining of brick, which, with the iron, would be 2 feet in thickness. Thus, while the outside diameter would be 27 feet, the inside would be 23 feet. Being in a circle, the whole of the space would not be available for vehicular traffic, but there would be sufficient height for a roadway 18 feet broad, which would be ample for two lines of vehicles. Many very busy streets in London have less width, and as there will be no interruption from cross traffic, the accommodation should be ample. No path is provided for foot passengers, as it would be practically impossible in the space at disposal, and the suggestion is made that they should be provided for either by electric tramways or a smaller and separate tunnel. The Bridges Committee of the County Council, who have the matter in hand, are apparently proceeding very cautiously in the matter. In addition to Sir Benjamin Baker's inquiry, the chief engineer has drawn up a report on the subject, and a full-size section of the tunnel is being prepared for the inspection of the members. We may expect in a short time their final decision, and if they should approve the plans we should not have to wait long for a much-needed means of communication between the north and south sides of the river.—*Pall Mall Gazette.*

What the nations of the earth are busily looking after is a high explosive that can be used in shells with reasonable safety to those using it; something that can be fired at long range, destroying the most property and killing the most people. Plenty of room for invention.

LETTERS FROM PRACTICAL MEN.

Rack and Gib Measuring.

Editor American Machinist:

Any one who has ever had many racks to fit in machine tools, must have felt the need of a better way of measuring the width to plane the rack than the "cut and try" method generally practiced, or the plan used in the best shops of measuring the width of space to top of pinion tooth, adding the working depth and planing to that measurement.

Feeling the need of something for this purpose led the writer to devise the tool shown, side view in Fig. 1, and two end views in Figs. 2 and 3.

A piece of rack precisely like that to be fitted is used, and to the back of this is dovetailed a piece so that the two, both being wedge shaped, will be parallel, and by sliding one upon the other, their width is increased or decreased till it fills the space, and runs with the pinion exactly as the rack should.

The pinions are usually so enclosed that they are hard to reach. To overcome this each part of the measuring rack is attached to a rod of suitable length to handle easily—the smaller one threaded, and has two knurled nuts working in piece clamped to large rod. One nut to adjust till space is filled; the other for locking while removing and measuring, which was done with a micrometer or vernier, according to width. Very satisfactory results were obtained, and no subsequent fitting required.

Planing gibs is also one of the difficult jobs, owing to the difficulty of measuring the space it is desired to fill. For this purpose I have seen a simple device, shown in Fig. 4, and this led to the tool just described. An improvement on this is shown in Fig. 5. With that all sizes above $\frac{1}{8}$ and below $\frac{7}{8}$ can be measured. This covers the sizes usually used.

This tool also makes a convenient height gauge for planer, thus measuring the space, and setting tool for planing gib with same tool. If desired to use it for other purposes, it can be made to measure in thousandths. Make the inclines 1″ rise in 10″ in length, and a scale graduated in hundredths. This could also be done on the rack-measuring device.

Neither of these is patented, and the cut shows them clearly enough so all can make who desire. DAVY.

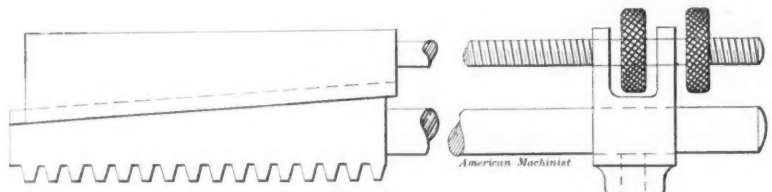
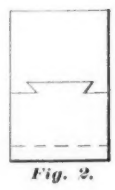


Fig. 1.



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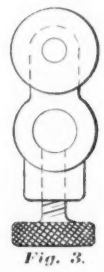


Fig. 3.

Fig. 4.

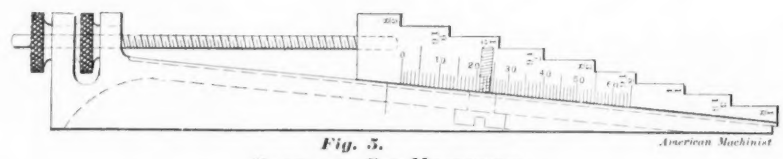


Fig. 5.

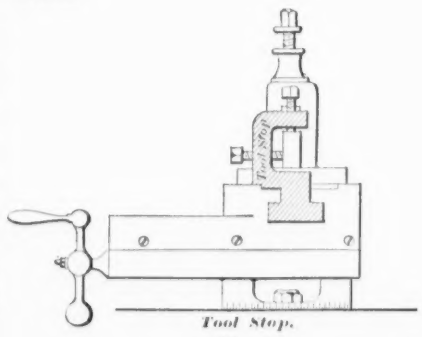
RACK AND GIB MEASURING.

Tool Stop—Air Compressor.

Editor American Machinist:

The sketch, Fig. 1, shows a very convenient tool stop, the office of which is to prevent lathe tools from swinging and bending in tool post. Great trouble of this kind is often experienced, especially with long boring tools; the device shown will prevent this to a great extent. It may be either forged, cast from brass or malleable, as suits the convenience.

Fig. 2 shows a very simple air compressor in use at the B. & M. R. R. shop at Plattsmouth, Nebraska. It is now very generally understood that much laborious work usually performed by hand may be economically done by lifting cylinders and small engines operated by suitably arranged pipes leading to the air reservoir. The pumps shown herewith are operated by belt connected to line shaft; the paper friction pinion may be engaged or thrown out by means of cams (*A′ A″*). It was thought advisable to have a loose pulley (*B*) also, so that the entire apparatus could be thrown out of motion. The air cylinders are old Westinghouse pumps. In connection with this machine there is also a good sized boiler used as a reservoir for air storage. L. C. SHARP.



Tool Stop.
Fig. 1.

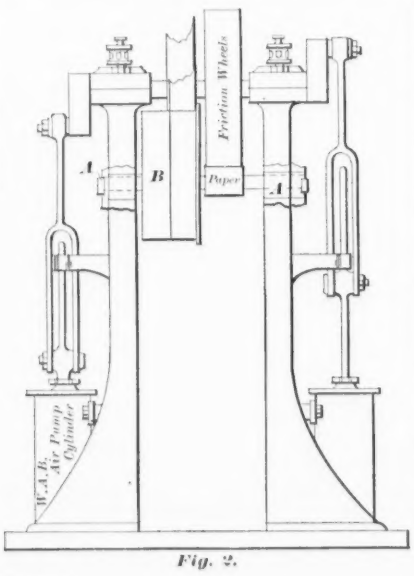


Fig. 2.

AIR COMPRESSOR.

Correcting the Error of a Screw.

Editor American Machinist:

I venture to assume that some of your readers may derive benefit from the following simple method of securing desirable results in the machine shop.

Often I have had the wish to make short measuring screws similar (and for similar uses) to micrometer screws, but have been deterred from the attempt for want of sufficient accuracy in the lead screws of available lathes. On one occasion, however, when my desire for such a screw was more than usually urgent, the solution of the problem presented itself unexpectedly to my mind.

Speaking of the inaccuracy of lead screws, I would mention that the concern with which I am connected has in use eighteen modern engine lathes, sixteen of which are made by one firm. Of these sixteen lathes one has a screw that does not vary more than $\frac{3}{1000}$″ in four feet from a "D., B. & S." standard steel rule, while the others vary from $\frac{1}{100}$″ to $\frac{3}{100}$″ in two feet. Now an error of $\frac{1}{1000}$″ in two feet can, in most work, be disregarded, and a mechanic who is fortunate enough to possess a lathe with so slight an error of lead screw could manage all ordinary requirements very well, and it is for those who cannot get nearer than $\frac{1}{100}$″ or so to the foot that I propose the following method of correction. Indeed, it will serve to correct a screw with an error amounting to five or ten times as much, and enable the manipulator to rival Whitworth in results, if in other respects he be capable.

The only precaution to be taken is to see that the lead screw of the lathe is not "drunk."

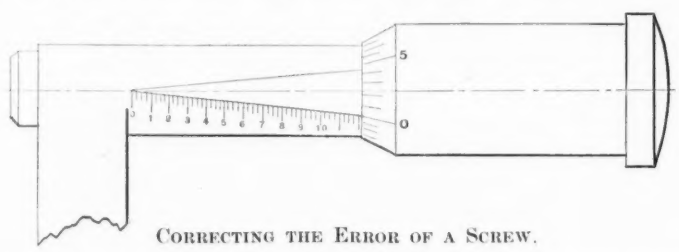
Having found a lathe with a "sober" screw, no matter how great its error of pitch, proceed to cut the micrometer screw and the taps (roughing and finishing taps). Graduate the index in the usual way, and mount the screw as if it were known to be perfect. Now bring the index to zero and make a mark on the stationary part of the machine; move the screw the distance of one inch (or such a number of inches as it is intended to measure), and introduce a standard of known accuracy; mark at zero again.

You have now secured the limiting points of your instrument, and all that needs to be done is to produce a regular line (or edge) extending between the points obtained. This line will be of such character as the error of the screw demands.

If the screw be of too fine pitch it will take the direction shown in full lines in the accompanying diagram. If, on the other hand, the pitch of the screw be too coarse, it will take the direction shown in dotted lines.

Chicago. C. C. HILL.

[Mr. Hill's assumption at the beginning of his letter is an entirely reasonable one, and we have no more doubt as to some of our readers deriving benefit from his communication than we have that he has hit upon a valuable means of correcting the errors of screws which are to be used for micrometer measurements. Mr. Hill is undoubtedly a good mechanic, and the fact that he is evidently unfamiliar with what has been done in this line, and really supposes himself to be the *first* inventor of the scheme, is of itself good evidence that others of our readers are unfamiliar with it. This is accounted for in part, we think, by the fact that makers of micrometers succeeded in making practically exact screws before micrometer calipers came into nearly so common use as now. Those who have one of the earlier micrometer calipers, purchased when such calipers first were placed on the market, will probably find, by sighting along the line drawn on the barrel, that it is not parallel with the center line, but is spiral, as indicated by the sketch of Mr. Hill, though, of course, not to the same degree. The later micrometers have a straight line, for the reason that, by the use of special machinery, screws are made which are sufficiently near perfect to come within the required limits of error for the purpose. Upon receipt of Mr. Hill's letter, and supposing, as we did, that Prof. John E. Sweet was the first to apply this method of correction to a screw, we wrote to him asking particulars regarding the matter, and have received the following very interesting letter in reply.—ED.]:



CORRECTING THE ERROR OF A SCREW.

Editor American Machinist:

Yours of the 15th at hand. When I first conceived the idea of correcting the imperfection in the pitch of the screw in a measuring machine in 1870 or '71, and which was first carried out in the machine at Cornell in '73 or '74, I supposed it was the first time it had been done. Later, Mr. John Richards, in reviewing what had been done in the line of measuring machines, allowed that, so far as he knew, it was first done in the Cornell machine; but some three or four years ago, in conversation with Mr. Charles T. Porter, he informed me that he had seen the same idea in a French micrometer at the Paris Exhibition in 1867. So that, so far as originality goes, it was, like many another stroke of American genius, stolen by the French or English a few years before its birth. JOHN E. SWEET.

Straight-way Valve—English Workmen.

Editor American Machinist:

In reply to "Bell Crank," the clear-way valve I sent was shown me as a valve for steam for pressure of, I believe, some hundreds. I have no knowledge of its behavior in practice, but sent it, as it seemed a novelty, and was of such construction as to allow of even seating of the valve. I should add that, so far as I know, it was for small sizes only.

Since the visit of the Iron and Steel Institute to America, many of the visitors have spoken at different society meetings of what they have seen.

One Mr. Dixon, a leading maker of tools in this country and a man of fair mind, has recently spoken of his observations, and he says that the tendency of modern American mechanical work is in two directions—one towards the attainment of a largest possible turnout, irrespective of all quality or finish; the other in the direction of an almost excessive refinement and redundancy of detail.

This double tendency is observable here also. There seems to be a point at which a manufacturer of any article may be said to arrive. He either secures a character for a super-excellence of work, and, obtaining good prices, is able to go along on the good road, and, finding good work to have paid him, perhaps carries the idea too far, or, unable to reach the top stratum, he is compelled towards competition, the natural outcome of which is inferiority of execution; and inferiority of execution cannot be delayed beyond the point at which further improvement in rapidity of good work is difficult or impossible.

Speaking of good work, I was shown a few days ago some good mechanical work in the shape of an American nail-making machine which cuts the stock from the rods of iron and, passing the blanks by gravity successively through a series of revolving dies or recessed rolls, turns out a very perfect, finished article. Any faulty blank causing

any error during the process will stop the machine, and, so to speak, hangs out a signal at the same time. The faulty nail or half-finished nail can be removed in a couple of seconds and the process be resumed. This machine is one of the finest examples of practically automatic mechanism I have seen, and is a credit to American machinists.

I know of another place, of which I must afford less specific information. It also is largely fitted from America. Here the other tendency has prevailed, and the mechanical work is essentially poor.

In this country there is a class of tool makers who build lathes, etc., for merchants. The makers' names do not appear upon them, and they are usually bad. Those who place their names on their own productions have usually some reputation to preserve or build up. Concerning these latter, Mr. Dixon does not consider they have anything to learn from American tool makers. He thought American boring machines were most excellent, but saw work too much pushed on them, some cylinders being "nearly red-hot" when the finishing cut was put through. The capacity of the machine seemed to him evidently greater than the need.

You refer to Mr. Lincoln's lecture at the Cooper Institute on English workmen. In speaking of the condition of London workmen as extremely bad at present, he was both right and wrong.

The employed class in London is not badly off, as compared with the condition of workingmen generally. Wages are fully equal in purchasing power to the best wages in America—in fact, better. Good workers earn from $10 to $20 per week of fifty-four hours, and pay about one-half American rates for most articles other than food, and that, on the whole, is cheaper than in America. But there is a large class of unemployed or half-employed men who are subject to competition with German and other Continental refugees from foreign persecution and rampant militarism and conscription.

The wages of a dock laborer, until recently one of the least-accounted occupations in London, are twelve cents an hour. Some few engaged in corn portering recently earned $30 a week. The dockers' twelve cents was attained as the result of a big strike, strongly supported by public opinion and subscriptions, and its success was due to a rapidly growing tendency towards a system of State socialism which has unconsciously developed in this country, and which recognizes the right of every man to a living, and discards the hitherto accepted idea that free competition alone is the arbiter of all men's lives. It certainly appears likely that free competition in a world whose vacant spaces are filled up can end only in disaster to the majority, if they are meek enough to endure it.

If it be true that for 150 years after the plague the English laborer lived better than ever before or since, it shows that their bad estate was and is due to unrestricted competition, the cessation of which and the enjoyment by the majority of the surplus results of their labor will come when the mass of the people gain the intelligence necessary to sway legislation. In claiming the admixture of four bloods in the English race, the lecturer made the common error of omitting the fifth, namely, the Roman. Few recognize how great was the influence exercised by this great colonizing people upon the character of this nation.

For four hundred years the Romans occupied this island. It is only three hundred years since Raleigh founded the colony of Virginia. In four hundred years the whole of England was under Roman influence. They constructed roads, still in existence as left by them; drained the fens, raised sea defenses, as witness still the Foss dyke and the Roman bank in Lincolnshire. A few weeks ago I put down three borings in the city of London as a test for the foundations of a new building. Two of them—only four inches diameter—yielded Roman pottery. An excavation in chalk a few miles down the Thames revealed an old Dene hole, a sort of bottle-shaped retreat excavated by ancient Britons. This had been found and utilized as a rubbish tip by the inhabitants of a Roman villa. It contained men's skulls, broken water bottles of both British and Roman manufacture, and some very fine pottery bearing the potter's name, "Licinivs." All these, which have their counterpart all over the country, are incontestable proof that the Romans effected a settlement far more permanent than a mere military occupation. When the Roman legions left, the colonists remained behind, and are still living in their modern descendants.

W. H. BOOTH.

Sketches of an Apprenticeship.

BY W. S. ROGERS.

As we built almost all varieties of engines in our shop, we cubs had good opportunities for studying how they acted when built, and many were the "suggestions" we made to the Old Man and the foreman regarding improvements. One engine in particular interested me because it was made to run both ways and was equipped with link motion just like a locomotive. Many were the questions I propounded to the jours and the Old Man in reference to the two eccentrics, the link and all the useless rigging (to my eyes) they were putting on that engine.

At last, failing to convince the Old Man that it was utterly uncalled for, I told him I would make an engine myself to work both ways with only one eccentric, and then he would see I was right. He approved of my plan and I set to work. As the shop was running overtime I had ample opportunity, for the Old Man did not believe in having the cubs work overtime (he said it made them grow tired of the business), but we could come around and use any of the tools that were idle, to work out our own "kinks."

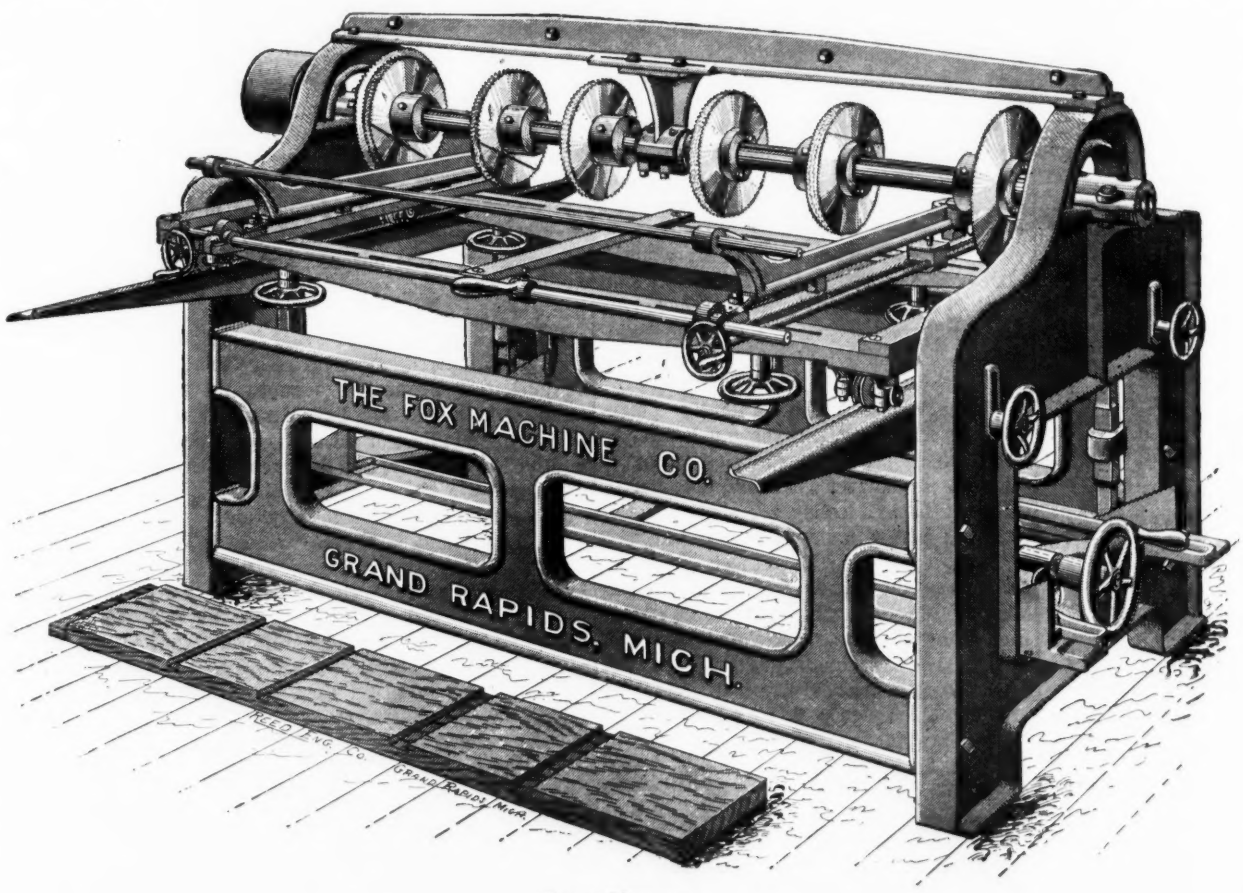
My first night at the shop found me not alone in taking advantage of my employer's kindness, as several of the other cubs were there too, making hammers, protractors, surface gauges and other implements for shop use, all different from any ever made before. Of course, Johnnie was out in the pattern shop making a tool chest that was going to revolutionize jour practice completely. It was a wonder, but I can't tell about it this trip. I worked on my engine many nights, gaining many a point that served me well in after years from the old jours, two or three of whom had run locomotives in their younger days, getting laughed at often by the younger jours, who told me I was wasting the best part of life, but finally I got it complete. The rock shaft was extended above the rocker box as well as below; there were two rocker pins, the one below for running under, the one above for running over. The end of the eccentric rod resembled the letter X, so that the lower fork hooked onto the lower pin, the upper or inverted fork acted opposite.

I called the Old Man's attention to it, and while he criticised my workmanship closely, and showed me how to improve, not a word did he say about that "improved valve motion." I felt hurt. My inventive genius had not been appreciated. I had seriously thought of giving the Old Man a half interest in it, but after such intentional ignorance on his part I changed my mind, decided to take it home and demonstrate it, and when I had reaped fame and wealth would he know the cost of snubbing a cub.

I did so, borrowing a small boiler and coupling the engine onto the family washing machine. As the weight on the safety valve was gone, I put two bricks on the valve, and whenever I hear a pop safety valve go off now I recall that incident, feeling myself to be the pioneer inventor of "pop" valves, for those bricks popped all the time. Well, that engine would pull running under, but it wouldn't pull running reversed. In fact, it required considerable assistance. Then it was that I took my first lesson on steam and on valve motion, and as I conned the "if and why" of it, wasn't I glad I didn't offer the Old Man that half interest?

Next day at the shop I told him it was a failure. "I supposed it would be," he said. "Why didn't you tell me at the beginning?" I questioned. "So you would remember not to butt your brains out against cold mechanical facts when you get older, instead of reasoning out the cause of existing conditions," he replied.

I have forgotten his advice several times in my life since, and it has cost me hard-earned dollars.



DADO MACHINE.

Dado Machine.

Our illustration on this page represents a dado machine made by the Fox Machine Co., of Grand Rapids, Mich.

As will be seen, the frame of the machine is heavy and substantial, and all joint surfaces in it are planed so that when bolted together the utmost stiffness is secured.

Slides are not used for the carriage, but it is supported upon grooved rollers, which allow the utmost freedom of movement.

The tracks upon which these rollers run are supported upon inclines in such a manner that, by giving one turn to the hand-wheel at the side of the machine near the floor, the table is moved vertically $\frac{1}{4}$", its total range of adjustment in this way being 4". The smaller hand-wheels at each corner secure the table in place when it is adjusted.

The arbor, which is of steel, $1\frac{5}{8}$" diameter, is key-seated its entire length, except at the bearings, and will carry any desired number of heads which can be adjusted to any desired position, the two end heads carrying cut-off saws, which simultaneously reduce the work to proper length. Stop gauges are placed upon the carriage, and the work is clamped by an eccentric which holds it securely to the carriage. Plain or patented adjustable dado heads may be used as desired, and the machine is made for work of different lengths, from 44 to 62 inches, and to use three to five heads.

Shop Floors.

Editor American Machinist:

"An Observer" makes a good suggestion when he corrects Mr. Wilson's article in regard to a floor for a machine shop, and his remarks agree exactly with our experience. We put down a floor when our shop was built six years since, just as Mr. Wilson suggests. The earth was dug and taken out, and ten inches of fine gravel filled in. In the gravel were placed 4x4 inch hard wood or pine pieces. The gravel was leveled even with the tops of the 4x4 inch pieces, and hard wood, unplaned, $1\frac{1}{2}$ inch boards spiked down so as to break joints. The 4x4 inch pieces rot and do not hold down ends of flooring.

In digging out for foundation for large drill recently, we found the 4x4 inch entirely rotten, and floor boards staying to their place by "force of habit," we suppose. The gravel is dry and there is good drainage. We think "Observer" suggests a good floor. By all means have good ventilation under floor.

COL.

The bridge across the Columbia River at Vancouver will be 600 feet in length, of steel, 40 feet above the highest water-mark. The cost will be more than one million dollars.

The cheap Hungarian labor so freely imported a few years ago has proved anything but a blessing. This class of labor appears to be particularly given to rioting on every possible occasion. The last occurrence of this kind was at Braddock, Pa., where several hundred of them charged the steel works, bent on stopping all work. They were stoutly resisted by the organized labor employed in the mill, and a good sized battle was the result. Such men can only be a curse to any country, and this is especially true of this country. Better let them go home.

AMERICAN MACHINIST

Communications relating to the reading columns should be addressed to the Editor. All other communications should be addressed:

AMERICAN MACHINIST,
96 FULTON ST., NEW YORK.

PUBLISHED WEEKLY AT
96 Fulton Street, New York.

HORACE B. MILLER, Pres't and Bus. Manager.
LYCURGUS B. MOORE, Treas. and Sec'y.

F. F. HEMENWAY, Editor and Mech. Engineer.
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Transient, 35c. per line, each insertion.
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The American News Company,
Publishers' Agents, New York.
The International News Company,
BREAM'S BLDG'S, Chancery Lane, LONDON, E. C., ENG., will receive subscriptions for the AMERICAN MACHINIST, at 16/6 per annum, postage paid.

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Subscriptions received in Australia by W. WILLIAMS, 17 and 21 Fink's Buildings, Melbourne,

NEW YORK, JANUARY 8, 1891.

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A Neglected Study.

There is one branch of knowledge which it is essential for the mechanical engineer to possess and yet which we seldom hear mentioned, and which we believe is not included in the curriculum of any school except the school of experience, where it is sometimes the chief study. We refer to the knowledge of how to manage employers.

It is undoubtedly true that a considerable proportion of the mechanical engineers of this country are so situated that no inconsiderable part of their ability and vital energy must be expended in overcoming prejudices, steering around idiosyncrasies and otherwise removing obstacles placed in the way of the success of their work by the very men who are most interested in its success—at least in a financial way.

There are a great many owners or part owners of machine shops, for instance, who know almost nothing of any branch of the science or practice of mechanics, who yet seem to think that it would be an inexcusable neglect of their business if they should allow any one about the place to take the responsibility for doing the least thing without first consulting them and explaining the matter in full and down to its smallest details. Such a proprietor wants nothing whatever to go on in his shop, even the most insignificant thing, unless he directs it. And if he does not actually direct it, then he must in some way be led to believe that he is doing so, or there will be trouble, and the diplomacy necessary to be exercised to make him thus believe, is often much more difficult than the planning and carrying out of the work.

Many a man employed as superintendent or foreman of a shop, for instance, in which engagement the ability to handle men is especially required and emphasized, finds upon actually taking hold of the work that the most difficult man to handle is the employer, who must be constantly "managed" in some way, and yet must never be allowed to suspect that he is being managed.

Such a shop owner will often take considerable pains in selecting for shop superintendent a man with a reputation for success in managing shops; the object, of course, being to get the benefit of his experience and talent in improving his own establishment. But a man who has made a success in such work is always a man of positive character, and of ideas, and no sooner is he fairly installed in his new place and begins to do the very things he supposed he was hired to do, than he finds his chief burden where probably he least expected it, *i. e.*, in the lack of confidence and the constant propensity to interfere upon the part of the proprietor.

Nothing is more discouraging to a man who is putting in his best efforts almost literally night and day, in order to bring a run-down shop into the highest state of efficiency, than to find his progress impeded at every turn by the very man who has most to gain by that progress.

We once knew of a proprietor of a machine shop, not himself a mechanic, who would not allow a grindstone to be thrown out and a new one put in the frame without his personal inspection of the old stone and approval of the change; his idea being apparently that, as his money paid for the new stone, he should decide whether it should be so spent or not. He never had ground a tool in his life, and, was almost as innocent of a knowledge of grindstones as grindstones were of a knowledge of him, while he had a man—the titular superintendent—who knew considerable about them and other mechanical matters as well; but this knowledge was of no value to either him or the proprietor, because it could not be effectively used. This shop finally got into such a state that the proprietor saw that something must be done. He innocently enough blamed his so-called superintendent for this, and resolved to get a better one. He got an excellent one, who, when our proprietor began to interfere with him, bluntly informed him that his reputation was at stake there, and if he couldn't be allowed to manage the shops himself, he would make way for some one else to manage them. He finally became disgusted and left, and it happened that the man secured in his place had what neither of his predecessors possessed, *i. e.*, the knowledge of how to manage a troublesome employer, in addition to his knowledge of the machine business and of shop management. He was successful because of the possession of knowledge which in reality ought not to have been required, and yet which is required in many similar positions, and probably will be until human nature is considerably improved.

It is a branch of study which many would find it profitable to pursue; but it can be and in fact is by some men studied too much, to the exclusion of other useful accomplishments. When carried to the extreme it makes of a man a mere schemer, and robs him of all taste for or interest in the more legitimate branches of knowledge connected with his profession.

Machine Compositors.

Another field of industry which seems destined to invasion by machinery is that of setting type for printing. Considerable printed matter is to be seen now in New York City, the composition for which is done by machinery, and the work is conceded by practical printers to be of a superior quality. In Brooklyn, Hartford and Cleveland, there are shops of considerable size which are devoted to making these machines, and it seems altogether probable that they are destined to come into use quite extensively for the kinds of work to which machine processes are adapted. It has seemed a very difficult task for the inventor to make a machine for this purpose, and a number of them have been engaged upon the problem for some time, with the curious and somewhat unexpected result that it has been discovered that the most promising method of type-setting by machinery is not to set type at all, strictly speaking, but to manufacture or cast them in lines of a length equal to the width of the column, and then remelt them after use.

One machine which operates in this way is provided with a key-board which is the same as that of the Remington type-writer. Strung on steel wires back of and above the key-board are strips of hard brass, in one side of which are the matrices for forming the type, a number of these being upon each wire and connected with each key. When the key is struck one of these brass strips is disengaged and slides by gravity down its own particular steel wire, all the strips finally arranging themselves in line, so that the matrices upon their sides form what may be called one side of a mold, the other side being formed by steel plates which are placed in proper position. This mold is then automatically filled with type metal upon the depression of a foot treadle, and the line of type so cast is shaved to the proper thickness, and put in place in what corresponds to a printer's stick. A space key is struck between each word, and this causes the insertion of what may be called a small washer, having a square hole through the center, and its side surfaces formed into a cam. The thinnest portion is first introduced between the strips, and when the line is completed these are all turned until the spaces between the words are extended sufficiently to make the line full and all the spaces in a given line are made precisely equal, which is not the case with hand composition, except for the finest book work. After a line is cast, the frame which supports the wires and key-board is tipped back until the matrices slide to their places again by gravity, and thus what is called the distribution is perfect and without the possibility of a mistake, whereas, in hand composition, imperfect distribution is usually the chief cause of mistakes.

A speed equal to that of the type-writing machine has not yet been attained, and probably will not be, but still the speed of the machine is far above that of hand composition, and it does not take a very great stretch of imagination to foresee the time when it will be the practice for the newspaper reporter to write out his short-hand notes upon such a machine.

This will probably cause some readjustment of things in the type founding and printing business, but in the end, if not at once, it will no doubt be for the good of all, and certainly the machinists will not be disposed to complain.

A good deal of recent discussion brings out prominently once more how little the wisest really know about the behavior of steam in the cylinder of a steam engine. Just now the discussion as to the utility of the steam jacket is in the front, and the conflicting testimony and opinions are anything but reassuring. The unprejudiced engineer is likely to conclude, from all this discussion, that there are cases where the steam jacket represents economy; also that there are cases where it brings about the reverse. But just what brings about this difference no one is wise enough to tell. What is needed is further knowledge of the law governing the condensation of steam in the cylinder of a steam engine; how it is effected by different conditions, etc. Then from this as a standpoint figures can be made to apply to steam jacketing. Until a good deal more is learned about condensation of steam, the doctors will disagree as to the value of any means tending to prevent it.

Literary Notes.

CATECHISM OF THE LOCOMOTIVE. Second Edition, Revised and Enlarged. By Matthias N. Forney, Mechanical Engineer.

Since the first edition of this catechism was published (1873) many changes and improvements in the construction of the locomotive have been made. In order to bring it up to the present state of locomotive engineering, the author has thoroughly revised it, rewritten a great part of it, added much new matter, and presents the results of his labors in this second edition. Among the new matter added we notice chapters on force and motion; resolution of motion and force; the principles of the lever; the action of the piston, connecting rod and crank; the Westinghouse air-brake; the care and use of air-brakes, and the Eames vacuum driving wheel brake. All the subjects treated on are made so plain that no one should have any difficulty in comprehending them. The book will be of great value, and is well adapted to those engaged in designing locomotives, locomotive engineers, firemen, mechanics, and all persons interested directly or indirectly in railroads, or any one desiring to obtain reliable information in an elementary way, of the construction of American locomotives. We recommend the book without hesitation. It is published by the *Railroad Gazette*, New York, and sold by Frederick Keppy, Scientific Book Publisher, Bridgeport, Conn. Price, $3.50.

FIRST LESSONS IN METAL WORKING. By Alfred G. Compton.

This is a book which is the outgrowth of the author's experience as instructor in charge of the workshops of the College of the City of New York, in which college he is also professor of applied mathematics. The book is designed primarily for the use of boys who are learning to work metals in schools, and nothing is taught in it which ought not to be thoroughly learned by any apprentice in a machine shop. Still there is much in it which is by no means always learned there, and the book contains many suggestions which will be apt to prove valable to learners. It is not an attempt to teach the working of metals by written instructions, but pretends only to give instructions and suggestions as to how best to proceed in learning by actual practice. The book contains chapters on the leading operations of blacksmithing, molding, vise work, soldering, etc., and is fully illustrated by the kind of cuts best adapted to such a work. It is published by John Wiley & Sons, New York. Price $1.50.

THE CIVIL ENGINEER'S POCKET-BOOK. By John C. Trautwine, C. E.

We have received a copy of the fifteenth edition and fortieth thousand of this well-

known work, which, as is indicated by the above figures, is so well known to engineers and mechanics as to need very little from us by way of introduction. Its clear, concise statements of facts, its accuracy, and the pains taken to make the information given as plain and easily understood as possible, have made it a favorite. Though designed primarily for civil engineers, its tables and clear treatment of mechanical matters make it a valuable book of reference for the mechanical engineer or machinist as well. It is published by John Wiley & Sons, New York. Price $5.00.

GENERAL SOLUTION OF THE TRANSMISSION OF FORCE IN A STEAM ENGINE, as influenced by the Action of Friction, Acceleration, and Gravity.

This is a pamphlet in which are included several papers by Prof. D. S. Jacobus, of Stevens Institute of Technology, in which he has gone into an elaborate, thorough and comprehensive mathematical study and treatment of the matters indicated by the title. The leading paper was presented at the New York meeting of the American Society of Mechanical Engineers, and is confined mainly to the presentation of results; the mathematical work by which these results were attained being given in the second paper presented at the Cincinnati meeting, and forming an appendix to the first, being presented in response to the request of several members of the society. This, together with a third paper on the "Effect of Friction at Connecting Rod Bearings on the Forces Transmitted," by Professors J. Burkitt Webb and Jacobus, being reprinted from *Annals of Mathematics*. The whole forms, we think, a valuable addition to the literature of the steam engine, and will, no doubt, be appreciated by very many engineers, though, of course, this appreciation will be confined to those who are familiar with the higher mathematics. The matter is all to be found in the printed transactions of the society, but in the pamphlet form will be more accessible to non-members, and more convenient.

The holiday number of the *Northwestern Miller* is a work of art from beginning to end. It contains more than sixty pages of choice reading matter, is printed on excellent paper, and is profusely illustrated. Those who got the paper together must divide honors with the printer, who has "done himself proud" in the art typographical. The price of this number is fifty cents.

QUESTIONS AND ANSWERS.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(16) E. C., Elburn, Ills., writes: Please give me some ideas of the duty of a mechanical engineer, and also that of a locomotive engineer. *A.*—The duties of a mechanical engineer have been stated in answer to Question 407 in our issue of Oct. 16, 1890. The duties of a locomotive engineer are to run a locomotive and take good care of it while under his charge.

(17) F. H. J., Angelica, N. Y., writes: I have some quite complicated drawings that will require a very large amount of work to trace. I require a copy of these. I could photograph them, but as my camera is small they will not be satisfactory. Can you give me a process whereby I can copy them easily, and not injure the originals. We know of no better way than to trace them. If the dimensions are marked upon them so that no measurement need to be taken from the copies, photographs taken with a suitable camera will answer the purpose. But photographs, no matter how carefully they are taken, will somewhat distort the proportions near the outer edges, thereby making the measurements unreliable.

(18) G. A. A., Corry, Pa., asks: Is the cylinder in the steamer "City of Paris" 113 inches inside or outside diameter? *A.*—When the diameter of a steam engine cylinder is given, the inside diameter is always meant. The engines on the "City of Paris" are a triple expansion engine, the high-pressure cylinder is 45 inches diameter; intermediate cylinder, 71 inches diameter; and high-pressure cylinder, 113 inches diameter; stroke of all, 5 feet. 2. What is the thickness of the cylinder? *A.*—We have not the dimensions of the details. 3. Was it cast in one piece? *A.*—The cylinder with its four valve boxes was cast in one piece, and weighed in the rough about 45 tons. 4. What is the size of the largest cylinder that has ever been made? *A.*—We have no record of cylinders, but we have read of cylinders 120 inches diameter.

(19) W. W., Post Falls, Idaho, sends us a drawing of a vertical boiler composed of two coils of copper tubes, ⅝ inch diameter. The water is fed through these tubes and discharged into three drums which are placed above the coils. The furnace is surrounded by brick and the whole covered with a wrought-iron casing. In regard to this boiler he says: "I have designed this boiler from rules found in Engineer's Pocket-books, but had difficulty in making them work out to suit my judgment. I therefore send the drawings to you and ask if there is anything wrong with the construction of the boiler and if it is properly proportioned for one horse-power. I have allowed 7 square feet of heating surface. *A.*—Your tubes are too small; they are liable to choke up. They should be about 1½ or 2 inches diameter. Your grate surface (8 inches diameter) is also too small. It should not be less than 15 inches in diameter. To be on the safe side we should give 9 square feet of heating surface per horse-power in boilers of this class. Provision should also be made for preventing the casing from becoming overheated. It is also better practice to allow the products of combustion to escape at the top of a boiler of this kind than at the sides, as indicated in your drawing. On the whole, we do not like the boiler. *Q.*—Please give simplest rules for designing small upright boilers. *A.*—See article treating on this subject in our issue of May 27, 1890.

(20) P. S., Danville, Ill., writes: I am desirous of knowing the strength of malleable iron in relation to cast-iron. We have certain castings which we intend to make of malleable iron; the dimensions of these cast-iron castings are known. What is the proper way of finding their thickness in malleable iron? Also what proportions do steel castings have to common cast-iron? *A*—The proportions of these castings will depend on the kind of stress to which they are subjeced. If, for instance, they are subjected to a tensile stress, their cross-sections, within elastic limits, will vary as the stress. Assuming that the safe working tensile strength of cast-iron subjected to a steady load is 3,000 pounds per square inch, and that of steel castings is 6,000 pounds per square inch, then the cross-sectional area of the latter will need to be ½ that of the former. The resistances of iron and steel to compression are governed in many cases by quite different laws. A piece of soft and tough steel will gradually yield by crushing, until it assumes the form of a button. A longer piece will yield similarly, until, reaching a certain limit of reduction, it will often split lengthwise; in still longer pieces, as in long columns, it will yield by bending laterally. A piece of cast-iron will break by crushing into fragments. The resistance to compression of malleable and steel castings vary considerably, and without special tests it is very difficult to say how much compression they can resist. In a general way, in the absence of special tests it may be said that, if the castings are subjected to a tensile stress, the malleable iron and steel castings may be made 50 per cent. lighter than the cast-iron ones; and if they are subjected to compressions it is very doubtful if any reduction can be made.

(21) H. M. C., ———, writes: In the 53d edition of Haswell, page 26, under "Measures of Length," I find the following: "Standard of measure is a brass scale, 82 inches in length, and the yard is measured between the 27th and 63d inches of it, which, at temperature of 62° is standard yard." I wish to ask, 1. Why do they not specify the width and thickness? If there is no difference as to the size of the cross-section of the scale, why not take the yard from the end or from any other graduations? Would not scales of the same material, but of different magnitude of cross-section, expand differently at the same temperature? *A.*—Mr. Geo. M. Bond, Manager of the Gauge Department, Pratt & Whitney Co., writes in reference to this matter as follows: "The scale is a bronze bar, with an inlaid silver scale, made for the United States by Troughton of London (see House Doc. No. 299, 22d Congress, 1st Session, and also Am Phil. Soc. Trans., Vol. 2, new series). It is nearly 86 inches long, 2½ inches wide, and ½ inch thick. A thin strip of silver, a little more than 0.1 inch wide, is inlaid, as above noted, with its surface flush with that of the brass, midway the width of the bar, except where interrupted by two perforations, one near each end. Two parallel lines about 0.1 inch apart are ruled longitudinally on the silver strip. The space between them is divided transversely into tenths of inches. The zero graduation is about 3.2 inches from the end of the bar. It is placed, when not in use, in a wooden box, into which it is fitted edgewise, and kept in a room, the temperature of which does not vary more than from 60 deg. to 80 deg. Fahrenheit. The yard of 36 inches comprised between the 27th and 63d inch of the Troughton scale was found by Hassler to be equal to the average 36 inches of the scale, and is the actual standard yard of the United States, having been adopted by the treasury department in 1832, on the recommendation of Mr. Hassler, then Superintendent Weights and Measures (Weights and Measures Report, Washington, 1857). As it was the intention that this yard should be equivalent to the English yard, its standard temperature depends on its relation to the imperial yard. The Troughton scale has never been directly compared with the British standard yard, but was simply copied from Troughton's own scale without subsequent verification (Report Supt. U. S. Coast and Geodetic Survey, 1877, Appendix No. 12)—Bureau Weights and Measures." While two bars of different cross-section would expand or contract differently with regard to the length of time required for them to get to the length corresponding to a given temperature after being exposed to air of that temperature, they should, if of precisely the same composition, eventually expand or contract to the same extent. 2. Please state of what value the metric system is to the American mechanic? *A.*—We do not believe it is of any value, but a familiarity with it and an occasional use of it is rather in the nature of a necessary evil. This is not considering the system by itself, however, but in its relation to the present systems, and the practical questions involved in a change from them to the metric.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Friday morning for the ensuing week's issue.

Grant's (1891) gear catalogue ready. See adv. p. 20.

Link-Belting and Sprocket Wheels.
Send for Catalogue of Link-Belting.
Over 50,000,000 feet of Link-Belt in use.
Link-Belt Engineering Co., Philadelphia and N. Y.

Shafting Straighteners. J. H. Wells, Tampa, Fla

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

Drop Presses, Punches and Shears. Williams, White & Co., Moline, Ill., manufacturers.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 8 Spruce St., New York.

Davis Key-Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St., N. Y.

The best Upright Hammers run by belt are made by Jenkins & Lingle, Bellefonte, Pa.

Ice and Refrigerating Machines, 155 sold, and all successful. David Boyle, 521 Monroe St., Chicago, Ill.

"How to Keep Boilers Clean." A 96-page book, mailed free by Jas. E. Hotchkiss, 120 Liberty st., N. Y.

Selden Packing for stuffing-box, with or without rubber core. Randolph Brandt, 38 CortlandSt., N. Y.

Milling Machines. Pedrick & Ayer, Philadelphia, Pa.

Universal Grinding Machine. Pedrick & Ayer, Philadelphia, Pa.

Drawing, mathematics and engineering studies taught by correspondence. I. D. Boyer, Dayton, O.

Light Special Machinery and Tools to order. The Meriden Machine Tool Co., Meriden, Conn.

Get particulars of our new Wall, Suspended and Radial Drills. C. H. Baush & Sons, Holyoke, Mass.

"Haswell," sent postpaid for $4.00 by Theo. Audel & Co., publishers, 91 Liberty street, N. Y.

"Roper's Handy Book." $3.50, sent postpaid by Theo. Audel & Co., publishers, 91 Liberty st., N. Y.

Curtis Pressure Regulators. Curtis Return Trap. Curtis Damper Regulator. See Dec. 18, p. 18. Send for circular No. 17. Curtis Reg. Co., Boston, Mass.

For the Latest Improved Diamond Prospecting Drill, address the M. C. Bullock Mfg. Co., 138 Jackson St., Chicago, Ill.

Send $1 for Catalogue D, Fine Tools and Supplies. Over 550 pages. Fully illust'd. Free when $10 worth goods are ordered. Frasse & Co., 92 Park Row, N. Y.

Audubon Machine Works, New Haven, Ct. Electrical work, superior facilities, builders of machinery, heavy and light.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocum & Son's Shafting Works, Drinker st., Philadelphia, Pa.

S. W. Card & Co., Mansfield, Mass., make everything in the line of Taps and Dies. S. A. Smith, 23 S. Canal St., Chicago, Western Agent.

For best Return Steam Traps, Pressure Regulators, Positive-Acting Pump Govs., Back-Pressure Valves. T. Kieley, 11 W. 13th st., N. Y. Send for des'n

Billings & Spencer Co.'s Packer & Boiler Ratchet, & all kinds of Forged Wrenches. S. A. Smith, 23 S. Canal St., Chicago, Western representative.

"Hawkins' Hand-book of Calculations" for engineers, machinists and steam users. Price, $2.50 postpaid. Theo. Audel & Co., pubs., 91 Liberty st., N. Y.

25″, 32″, 37″, 42″ — "Only Drill Press built on 'Ko-rekt' principles, even if they come from Jersey." Gould & Eberhardt, New Ark, N. J.

Patent Attorney R. G. DuBois, 715 11th street, Washington, D. C., procures 1st-class patents for inventors. Send for pamphlet. Guaranteed by Rand, McNally & Co., of Chicago.

Patent Soliciting of High Class.
D. Walter Brown, Counsel in Patent Cases.
31 Nassau street, New York.
Send for Brief History of Patent Legislation.

Agents wanted in every town and village in the United States to sell our clipper knife and scissor grinder, something that every housekeeper should have; liberal terms. For particulars address Montgomery & Co., 105 Fulton street, New York City.

Every draftsman needs one. The Engineer's Sketch Book of mechanical movements, appliances, devices, contrivances, etc., by T. W. Barber. 1,936 illustrations, 8vo. cloth, $3. Catalogue of books on mech. subjects free. E. & F. N. Spon, 12 Cortlandt St., New York.

De Lamater Screw Propeller Wheel made only by The Samuel L. Moore & Sons Co., Elizabethport, N. J., who have purchased from C. H. De Lamater & Co., New York, all their patterns, books of record, gauges, etc. Location and equipment well adapted for Heavy Steamship Repairs.

Stub Ends and Connecting Rods for small connections. Especially adapted for Valve Rod for Steam Engines.
T. C. Dill Machine Co., Philadelphia, Pa.

"Binders" for the American Machinist. Two styles, the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. American Machinist Publishing Co., 96 Fulton St., New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price $2, postpaid. Published by John Wiley & Sons, 53 East 10th St., New York.

MANUFACTURES.

The erection of a cotton factory is talked of at Talladega, Ala.

An agricultural implement factory will be erected at Cordele, Ga.

The Hercules Iron Works plant at Aurora, Ill., has been completed.

The Wilmington (N. C.) cotton-mills will put in additional machinery.

S. R. Hufford and others are erecting a woolen-mill at Wytheville, Va.

The erection of a cotton tie factory at Selma Ala., is being agitated.

W. H. Wright is erecting a new iron and brass foundry at Easton, Md.

Little Rock, Ark., will put additional machinery in its electric light plant.

The Gogebic Boiler Works, at Duluth, Minn., will soon double their capacity.

It is probable that an iron foundry will be established at Weatherford, Tex.

A foundry, wheel and handle works will probably be established at Jasper, Tenn.

It is stated that a Canada steel manufacturer will remove his plant to Atlanta, Ga.

Blaine Bros are reported as enlarging their car shops at Green Cove Springs, Fla.

The Roanoke (Va.) Machine Works will probably rebuild its $25,000 blacksmith shop.

There is some probability that a steel plant will be established at Clarksville, Tenn.

Additional machinery is to be put in by the Piedmont (Ala.) Planing-mills Company.

The Batesville Iron Works, Batesville, Ala., will add a foundry to its machine shops.

Liddell & Co. are about to build a large machine shop and foundry at Charlotte, S. C.

The Tombigbee Iron Works, at Aberdeen, Miss., expects to add car works to its plant.

The Peninsular Car Works, of Detroit, Mich., will probably be removed to Seattle, Wash.

The Barton Agricultural Works are being removed from Sheffield to Tuscumbia, Ala.

The contract has been signed for the establishment of an iron foundry at Waynesboro, Va.

A $300,000 stock company is reported as incorporated, to establish iron works at Jasper, Tenn.

The Alabama Great Southern Railroad Co. is reported as to build repair shops at Attalla, Ala.

A $30,000 stock company is reported as incorporated to establish iron works at Jasper, Tenn.

The Southern Electric Street Car Company has been formed at Roanoke, Va. Capital, $500,000.

A $25,000 stock company will, it is stated, be organized to erect a knitting-mill at Raleigh, N. C.

The Southern Machinery Company, at Atlanta, Ga., contemplates increasing its capital stock $50,000.

Northern parties are reported as to remove a $500,000 nut and bolt factory to Fort Payne, Ala.

The Sanitary Silex Co. (Baltimore, Md.,) may erect a factory for the manufacture of its patent piping.

The silk-mills at Fredericksburg, Va., owned and operated by C. W. Wilder & Co., are to be enlarged.

Contract is reported as having been signed for the establishment of an iron foundry at Waynesboro, Va.

It is stated that the Norfolk & Western Railroad Company will establish car shops at Radford, Va.

Machine shops are to be erected at Knoxville, Tenn., by the Knoxville Southern Railroad Company.

It is stated that the Norfolk & Western Rail. road Company will build machine shops at Kenova, W. Va.

The establishment of a cotton factory is contemplated at Greensboro, Ga., by Greene county parties.

The Texas Rolling-mill Company, recently incorporated at Fort Worth, Tex., has a capital stock of $50,000.

The Chattanooga (Tenn.) Car and Foundry Company is rebuilding its foundry, which was lately burned.

A $100,000 cotton factory is reported as to be erected at Cheraw, S. C. H. L. Souchlin can give information.

The Adams Saw-mill Works, of Chattanooga, Tenn., are adding an iron foundry, machine and boiler shops.

The Ingersoll Mining Machine Company, of Cleveland, will remove their plant to Rockford, Ill., at an early date.

The capital stock of the Jenckes Machine Co., Sherbrooke, Quebec, Can., has been increased from $75,000 to $100,000.

J. F. Johnson, in company with Eastern capitalists, is thinking of establishing a 75-ton rolling-mill at Birmingham, Ala.

W. H. Phillips, of Taunton, Mass., will, it is stated, probably remove his foundry and machine shops to Middlesborough, Ky.

Miller Bros. contemplate the erection of a casting foundry at Columbia Heights, S. C., to utilize the sandy soil at that point.

The machine shops of the Missouri, Kansas & Texas Railway Company, located at Greenville, Tex., are to be enlarged.

The Richmond Ice Machine Company is building new shops for the manufacture of machines in the suburbs of Richmond, Va.

The St. Louis, Arkansas & Texas Railroad Co. is reported as having secured site, and is to erect car shops at Pine Bluffs, Ark.

At Harriman, Tenn., the Harriman Tack Co. have been incorporated, to purchase and operate the tack factory of Fosgate & Lane.

The Lone Star Ice Company, at Austin, Tex., it is stated, is contemplating establishing a foundry and machine works at Jefferson.

The Eureka Mills is reported as erecting an addition to its cotton factory, at Mortimer, Tenn., and as to put in new machinery.

The Louisville (Ky.) Cotton-mills Co. has increased its capital stock $50,000, and will put additional machinery in its cotton-mill.

The River Machine Company, of Cleveland, O., will erect an additional machine and boiler shop, 100x80 feet, three stories high.

The Columbus Iron Works Co., of Columbus, Ga., are preparing to place in position in their foundry an electric welding equipment.

A new machine shop, 50x100 feet in dimensions, is being erected at Clarendon, Tex., by the Fort Worth & Denver City Railroad Co.

The Harless Car Door Co. is reported as organized at Anniston, Ala., to manufacture the patent car door of J. D. Harless, of Glen Addie.

The Salem Iron Works, with a maximum capital stock of $300,000, have been organized at Salem, Ga., to establish a wire nail factory.

The new manufacturing plant of the Michigan Railway Supply Company, at Detroit, is nearly completed. The main building is 75x300 feet.

The Clayton Motor Co., of Atlanta, Ga., is reported as to erect in Gordonsville, Va., a factory for the manufacture of its sewing machine motors.

Machine works for the manufacture of saw-mill machinery will probably be established at Buchanan, Va. I. Z. Schultz can give information.

The Missouri, Kansas & Texas Railway Company (office, Parsons, Kans.,) contemplates the enlargement of its Greenville (Tex.) machine shops.

R. E. Frazer, L. S. Ehrich, S. S. Fraser, and others, have incorporated the Georgetown (S. C.) Ice Co., to erect an ice factory. The capital stock is $8,000.

C. B. Smith and others have incorporated the Parkersburg (W. Va.) Hardware and Manufacturing Company to deal in and manufacture hardware.

The Carroll (Md.) woolen-mills, recently incorporated, will operate the woolen-mill of Albert Felber, near Carroll, and may put in additional machinery.

Bloom Brown, C. P. Payne, and E. P. Harris have incorporated the Americus (Ga.) Supply Co. for the purpose of dealing in and manufacturing machinery of all kinds.

J. H. Huiett, L. D. Cullum, N. A. Bates and others have incorporated at Batesburg, S. C., the Batesburg Manufacturing Company, with a capital stock of $5,000.

The Crucible Iron and Steel Works, East St. Louis, Ill., will nearly double their capacity by the erection of a new foundry 100x64 feet. The improvements will cost $100,000.

William Kehoe & Co., Savannah, Ga., are reported as enlarging their iron works, and putting in new machinery for the purpose of manufacturing steam sugar-mills.

The Steel Sink, Range, Boiler and Stamping Co., of Ontario, has been incorporated at Toronto, Can., with a capital stock of $50,000, for the purpose indicated by the name.

It is stated that a St. Paul syndicate has purchased for $300,000 the stove works of Redway & Burton, in Cincinnati, Ohio, and will remove the plant to St. Paul, Va.

The Totten & Hogg Iron and Steel Foundry Company are making a number of important additions to their works, corner Twenty-fourth and Railroad streets, Pittsburgh, Pa.

The Triple Wire Nail Machine Co., lately reported as incorporated, to erect a Hastings wire nail factory in Parkersburg, will, it is stated, erect another factory in Huntington, W. Va.

The Hogan Refrigerator Car Company, of Chicago, has been incorporated, for the manufacture of refrigerator cars; incorporators, E. J. Johnson, Annetta Woodward and H. R. Pearson.

J. D. Weeks, E. Dillon, M. H. Payne, and others, have organized the Buchanan (Va.) Steel Works for the purpose of manufacturing steel by the Adams direct process. The capital stock is $100,000.

The Hattiesburg Machinery and Car Manufacturing Company has been incorporated at Hattiesburg, Miss., by F. E. Colborth, G. E. Kemper, T. J. George and others. A site has been secured.

Henry Essex, W. H. Smith, E. M. Eaton and others have incorporated the Essex & Smith Manufacturing Company, at Chattanooga, Tenn., to deal in and manufacture castings, implements and machinery.

A stock company has been organized at Port Republic, Va., with E. R. Armentrout, president, for the purpose of erecting machine shops in Shendun; building to be 80x65 feet. The minimum capital stock is $10,000.

The Quebec Machine and Foundry Co., with headquarters at the City of Quebec, Can., will be incorporated, with a capital stock of $30,000, to carry on the business of iron founders, machinists and general workers in iron.

The Parkersburg Hardware and Manufacturing Company has been incorporated by Hon. C. B. Smith and others. It proposes to do a general hardware and general manufacturing business at Parkersburg, W. Va.

The Abutment Gate Company, of Chicago, has been incorporated, for the manufacture of safety gates and other improvements for bridges; capital stock, $300,000; incorporators, E. Leech, H. S. Williams and H. H. Ware.

The Twin City Iron Company has been incorporated at Front Royal, Va., with T. S. R. Flickwir, president, and D. W. Flickwir, secretary, to develop iron mines, build iron furnaces, etc. The maximum capital stock is $200,000.

The Ryan-McDonald Mfg. Company, of Waterloo, N. Y., are to remove their machine works to Curtis Bay, Md., where a company with $100,000 capital stock will be incorporated, and where a building 350x70 feet will be erected.

The Drexel Car Coupler Company, of Chicago, has been incorporated, for the manufacture and sale of car couplers and railway appliances; capital stock, $600,000; incorporators, William A. Alexander, A. C. McCord and D. W. McCord.

The Milwaukee (Wis.) Street Railway Company, with a capital stock of $5,000,000, proposes to construct, operate and maintain street railways, using electric or other machine power. A preliminary capital of $1,000 has been paid in.

The Fairmont Machine Works Company has been incorporated, with a capital stock of $100,000, by nine Marion county men, to build a machine shop and foundry at Fairmont, W. Va. It will make a patented coal car wheel for a staple.

The Pittsburgh (Pa.) Portable Forge Company, recently organized in Pittsburgh, have commenced the erection of their plant on Smallman street, in that city. In addition to forges they will manufacture railings, gratings and steel barrows.

The Parkersburg Hardware and Manufacturing Company has been incorporated by Hon. C. B. Smith and others. It proposes to do a general manufacturing and hardware business at Parkersburg, W. Va. The capital stock is $15,000.

A new industry is starting up in Ottawa, Can. The old Baldwin foundry, having lain idle for some months, has recently been acquired by Messrs. George Roe and Robert Graham, who will run it under the style of the Baldwin Iron Works.

New repair shops are being erected at Nicetown, Pa., by the Philadelphia & Reading, to take the place of the old shops at Third and Berks streets in Philadelphia. The new building will be 307x176 feet, with an extension 25x36 feet. Construction has begun.

The Lincoln Iron Works (Rutland, Vt.,) has issued a new and enlarged catalogue of special machinery for working and handling stone and marble. They make a large variety of machinery for this purpose, which is well illustrated and described in the catalogue.

The Leffel Water Wheel and Engine Co. (Springfield, Ohio,) has issued a new catalogue of water wheels and engines, heavy gearing, shafting and specialties used in the transmission of power. The catalogue contains useful information in engineering matters.

The Gennett Air-brake Company has been incorporated, with headquarters at Chicago, Ill., to manufacture air-brakes. The authorized capital stock is $800,000, and the incorporators are: David Wallach, Phillip Opper, Isaac Neuberger and Moses L. Rothchild.

The new iron roof for the extension of the rolling-mill for the Lackawanna Iron & Coal Co., at Scranton, Pa., will be built by the Berlin Iron Bridge Company. The same company is also putting up the new casting shop for the Midvale Steel Company at Nicetown, Pa.

We have received a remarkably finely illustrated and printed catalogue of the Roney Mechanical Stoker, as made by Westinghouse, Church, Kerr & Co., Chicago, Ill. This stoker has already been applied to a large number of boilers, and is said to work with entire satisfaction.

Superintendent George H. Wiley, of the Utica Steam Cotton-mills Company, Utica, N. Y., announces that during the coming spring improvements will be made on the company's plant at a cost of nearly $100,000. The plans and specifications are now being completed.

The new shops of the Grand Trunk at Sarnia, Ont., north of the tunnel portal, are now under way. In addition to blacksmith and machine shops the plant will have pumping engines for the tunnel, power for lighting the tunnel by electricity, and other necessary apparatus.

There is water-works agitation in North Knoxville, Tenn.; Kansas City, Mo.; Auburn, N. Y.; Salem, Ore.; Woodland, Cal.; New Orleans, La.; Norfolk, Va.; Sterling, Col.; Grand Rapids, Mich.; Argonia, Kan.; Mason, Mich.; Fairland, Tex.; Lima, O.; Sioux City, Mo.; Kansas City, Kan.; Pasadena, Cal.

A corporation to be known as the American Electric Machinery Company has been organized at Portland, Me., with a capital stock of $10,000, $200 paid in, for the purpose of manufacturing machinery. The officers are: President, Daniel W. Scribney, of Portland; treasurer, S. Lewis Moody, of Saco.

On the 10th inst., a charter was granted to the Pennsylvania Foundry and Machine Company, of Pittsburgh, with a capital stock of $30,000. The following are the directors of the new company: Theodore Doerflinger, George P. Letche, Wm. J. Woods, Morton Hunter and John M. Griffin, of Pittsburgh.

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Arrangements are being made by the Board of Directors of the Irish Creek Mineral and Development Company to effect the organization of the company. Nearly all of the stock is reported to have been taken, and negotiations are being conducted with a large steel plant in the North to locate works at Cornwall, Va.

Prominent capitalists of Milwaukee and the East are reported to have purchased a large tract of land near Milwaukee, Wis., upon which it is proposed to erect large car works to give employment to 1,000 men. The proprietors of the Milwaukee Car Wheel Works are said to be interested. Work on the buildings is to begin soon.

The Bellaire Stamping Co., of Bellaire, O., have commenced the erection of a three-story iron building to take the place of the wooden building destroyed by fire some weeks ago. The firm have now a force of machinists at work preparing dies to be used in the new plant, and they expect to resume business again about January 15.

M. M. Strause, Leon Wallerstein, Samuel Proskaner, and others, have incorporated (at Richmond, Va.,) the York Steel and Iron Co., to deal in real estate, build iron furnaces, etc. It is stated that the company has purchased iron ore lands near Yorkville, S. C., on which it proposes to construct iron furnaces and steel plant. The capital stock is to be not less than $100,000 nor more than $1,000,000.

An effort is being made to place car shops at Bristol, Tenn. The proposed company is to be capitalized at $500,000, and the plant is to be of a capacity to turn out from five to eight cars per day, besides having facilities for repairing damaged cars. The site will require not less than twenty acres, which is to be occupied by five buildings, outside the main shops, these buildings to cost $35,000.

The Southern Malleable Iron Works, at Chattanooga, Tenn., is nearing completion. The company expect to have the building under roof by the end of this month and have the foundry in running condition by the middle of January. Charles A. Barer, of Cincinnati, Ohio, will have charge of the foundry. The president and general manager of the company is Charles Heron, and P. A. Browner is secretary and treasurer.

The New Process Raw Hide Company, Syracuse, N. Y., has received the following letter from Thos. G. Fitch, general manager of the Wichita (Kansas) Electric Company: "Replying to your favor of Dec. 6th., will state we have used your rawhide pinions off and on since last May, together with various other kinds of pinions. We believe that your rawhide pinions are the best on the market at the present time. The first one we put on in May, 1890; this pinion was in service seven months, and was not then entirely worn out." The new process rawhide is distinctively different from other rawhide, and is said to be manufactured by no other firm in the world.

About Screw Threads—Oscillating Shafts.

BY A MECHANIC.

Mr. Woodward, in the AMERICAN MACHINIST of October 30th, recommends for fitting a lathe face-plate a short screw thread loosely fitted, and a plain fit turned near the collar to fit a recess bored in the face-plate for the purpose of centering it.

Bell Crank, in a later issue, thinks that the plain cylindrical fit will soon wear, and so recommends a taper fit instead, for then when any looseness is found a little squared off the collar will make it fit again.

Now I want to know what is the matter with what we have already got?

This is a point where the interchangeable plan should be worked as far as is practicable, and so the most simple and easily made plan is the best. To have a face-plate bring up against a square shoulder, and a taper at the same time, is a fine point, although not impracticable.

There are some rigs used on the spindle more than others, and so in time the one that is used the most will be found to have worn the most, and if the spindle is then made to fit this one the rest won't go up to the shoulder.

Now if we can avoid this, and at the same time find a plan where the first cost is less, it is worth trying.

When talking with a mechanic some time ago about the need of having all screw threads fit nicely (I maintaining that in a great many cases there was no need of a good fit) he mentioned the fit of a lathe face-plate, saying that if in this case the fit was not good, it never could be relied upon to run true. The face-plate of the lathe I was working on at the time was about as loose as any we usually see, so I showed him that that one was quite true, and that we could unscrew and screw it up as many times as we wanted to without appearing to change the truth at all. He was obliged to admit that the practice he saw did not fit his theory. The truth of the matter is this: A V-thread acts as a number of cones, and so centers the plate. In the illustration I show a form of thread that I believe would prove more suitable for this purpose. I should have the thread made to an angle of 45° with the center line instead of 60°. I believe it would be a good plan to cut a slot through the thread on spindle for the purpose of cleaning out the thread in plate. Then when screwing on plate, if we turn the slot up the weight of plate will keep the threads in contact, and so clean out all dirt.

Such a plan does not require nice fits, only that the angles conform. No matter how snug the fit is made, when the plate is screwed up hard against the shoulder there will be clearance on one side of the thread as is shown, and, so long as there is no contact, the space might be an indefinite amount only for what the thread would be weakened.

Some one asked Mr. Thomas Edison what kind of new contrivance was most likely to succeed, and was answered that a thing that is of general use, and is so simple that a donkey could operate it, is sure of success.

I believe this applies very well to machine design. Where fine points can be avoided it is best to do so. There are lots of elegant machines designed and built that would be successful enough, if it were only practicable to furnish a small machine shop and a few good mechanics with each one.

In the case of bolts where the nuts are likely to work loose, it is good to have the threads bear tight on top, for then we have a simple nut lock. For the bolts usually used around the machine shop for clamping work, I believe that the nuts usually are fitted too snug; for, as soon as the thread gets strained a little, as it is bound to after a little use, the nuts get to going very tight, and are a nuisance. I think that a little reflection will convince most any one that, if the nuts on such bolts do shake a little, there will be no damage done.

I remember of making a large saw arbor when an apprentice. I had an idea that the nut must fit very snug. I was going to cut

the thread just so I could squeeze the nut on with a wrench, and then work it back and forth till I got it loosened up to suit me.

I made a miscalculation, however, and when I came to try the nut I found it screwed clear up easily without wrench. I thought I had spoiled it, so, calling the foreman, who was passing at the time, I showed it to him expecting to get a "dressing down." "What's the matter with it?" he asked. I commenced to explain how my foot slipped. "Well," he says, "if you get all of your work as good as that I won't kick." He was a man who believed in saving time and fine hairs for a job that needed it. There are lots of men who pretend much, but who think that such nuts should be good fits. Of course the angles should conform, but as far as a little backlash in such a fit is concerned, it will neither make nor break anything.

"Jarno," in the AMERICAN MACHINIST some time ago, tells of a scheme proposed by Mr. Norton to keep nuts on oscillating shafts from working off. Now it seems to me that a nut used as he suggests only answers the purpose of keeping the gear or whatever it may be from falling off. A split pin put through the shaft outside of gear would answer as well. I believe such nuts are usually used to force the hub against a shoulder, and so generally strengthen the fit.

A gear with a short hub can be made to run true when so forced against a true shoulder. I have found that for oscillating shafts where anything like heavy work is done, that good fits in both the shafts and keys are absolutely necessary, and that there is no chance for any kind of a compromise with schemes to keep nuts from working off.

If there is ever so little shake on the key when first started, a little wear will commence, and every little increases the length of stroke, and so the weight of blow, till at last the key-way in both shaft and hole gets all out of shape, and then there is trouble. When shaft and key are good fits, and a nut is fitted so as to force the hub against a shoulder in the usual way, and there is proper strength for the work, I don't believe that Jarno or Mr. Norton or anybody else ever saw any trouble.

I remember when working in a jobbing shop a number of years ago, that a telegram came to the shop one night in the winter from a pulp-mill about 40 miles up the river. It said; "Send man to-night with chisels, to fit keys in large wheel."

I got the job. We had to guess what chisels and other tools we needed, but, however, I managed to get to the mill that night about 10 o'clock with an odd collection that I thought would answer for almost any job.

I was shown the job, and the first look made me tired. There was a machine there that I believe they called a "chipper."

It was a large face wheel with planer knives set in all around, and so arranged that the wood that was fed down a spout would come in contact with the knives, and so chew up lumber and spit out the splinters about as fast as two men could throw it in the spout. This machine was driven by the tail end of the mill line shaft, which was at this point about four inches in diameter.

The driving wheel was about 9 feet diameter, with 10 or 12 inches face, and I think was only a makeshift here, for it looked to me as though it was originally a fly-wheel for a steam engine, for it was very heavy.

The hub was about 16 inches long and was chambered; I think the fit at each end was about 4 inches long. There had been two keys fitted, quartering in the shaft; the keys going clear through the hub.

These keys were originally, I think, about $\frac{1}{4}$ inch wide, and probably when new were about square at the butt, and tapering a little on top. Evidently the fit on the shaft had never been good, but there was evidence that it had been keyed for all it was worth.

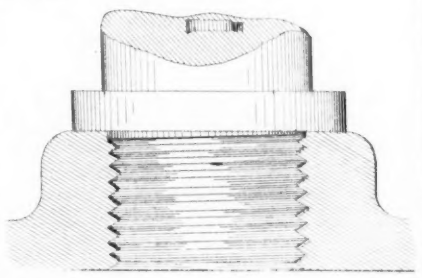
Now this heavy wheel, after getting started, was more interested in going than the rest of the mill was, and after the power was shut off it would surge ahead on these keys very hard.

When the line shaft was first started, it seemed to be more interested in going than the wheel did, so the keys got another bump.

Perhaps it got other bumps that I haven't been able to "get onto"; at any rate, the two key-ways in the shaft got worn into one, and better, and then it seemed that a change was desired; for the keys stopped in the shaft, and wore the rest of the way in the wheel, so when I got there it was a "loose pulley," but not a very quiet running one, though. The foreman of the mill was reasonable. He did not ask me to key that wheel on so it would never give more trouble, for he said he did not believe this could be done, but that he wanted to make it run long enough to get enough stock chipped up ahead to last the mill while the wheel was being bored and a larger shaft fitted.

I think I succeeded in this, for I never heard any complaint, but since then I have a profound respect for such rigging. This was not an oscillating shaft, but it shows the principle.

I have a few more words about screw threads.



Square thread screws, such as are used for feeds in machine tools, are sometimes fitted too snug. I have seen such screws cut very tight for the nut (which was brass), and worked free by running back and forth in the lathe, and emery used quite freely, too. Somebody in the AMERICAN MACHINIST quite a while ago said, that in buying a machine tool, the first thing inspected usually was these screws, to see how much "back-lash" there was. It seems to me that, if some of these inspectors knew how some of the very close fits were made, they would choose to take a little more shake, and not so much emery.

Laying the emery question aside, I believe such screws should have sufficient clearance when new to allow the oil to easily work clear through the nut. It will be only a very short time before this clearance is got any way, and when it is got by wear without oil, the surface is left in good condition to promote rapid wear, where, if the work had been originally fitted in that way, the lifetime of the screw would be longer.

Melting Iron—Mixing Steel with Cast-iron.

BY CHARLES SMITH.

It is often said that the most leaks in a foundry occur in the melting of iron, or around the cupola. So many things enter into the production of good castings, so many things which, if neglected, poor castings are the result, that a most intelligent and painstaking study of the matter must be given to produce economical and satisfactory results.

The cupola needs good and faithful attention in preparing for the daily heats, and it will always repay the attention paid. If you see a cupola scaffolding or surroundings free from old ladle sculls, accumulated shot from the rattlers, and foundry refuse generally, you can depend upon good management there; but if the same space is utilized as a dumping ground for the refuse of the whole shop, the interest on that pile is counting into dollars at a compound rate.

After being chipped out carefully, the walls of a cupola should be daubed from one-half to one inch thick with clay and fire or bank sand in the proportion of one-half each.

Blue clay will do better than fire clay, as it is more adhesive and clings better to the bricks, and where the daubing is renewed daily is preferable to fire clay. In lining up I have found from experience that a blue clay lining between and back of the fire brick lasts fully as long as the fire clay, for after it receives its first glazed coat of slag, any difference in the clay in which the bricks are laid will not be noticed. If strict attention is paid daily to the daubing of the inside of the cupola, it is astonishing how long it will run without re-lining. I have in view a cupola at Corning, N. Y., 32" diameter—inside measurement—that has been running four years with almost daily heats, and when I looked at it a couple of weeks ago it still looked fairly well, owing to the care bestowed upon it by the faithful old melter.

Any cupola from 24" to 30" (inside) will run with daily heats from one to two years without re-lining if proper care is taken in chipping out and daubing up, and cupolas from 36" to 60" will run from six months to one year, daily carrying heats that test their capacity, if properly cared for.

It will not do to knock off some of the largest lumps adhering to the inside of the furnace after a heat, and throw some clay into the holes. One melter running from seven to ten tons daily through a 38" cupola, told me he could chip and daub his furnace in thirty minutes. I asked him how often he re-lined and he said, "Every two or three months." We cannot make a hole in the ground to take care of seven to ten tons of metal properly in thirty minutes. Yet this melter unchecked was daily doing something as seemingly impossible. We do not expect to throw a mold together, the casting of which will weigh tons, and depend on luck to bring us good results. No, we start systematically from the beginning, laying the foundation for a good clean job. We should start equally well and carefully at the cupola, the main root in the production of good sound castings. We must also thoroughly know, from tests or experience, just the quality of castings the mixture going into the cupalo will produce.

The molder has no control over the mixture of metal that enters his mold. He can ram properly, vent carefully, finish neatly, gate systematically, and secure his mold in a good, common sense, practical sort of way—the way in which his experience teaches him is right; but if the mixture entering the cupola is not right he will never get the casting his carefulness justifies him in expecting. It may lack strength, may be porous, may be hard, may have shrink holes, may crack in cooling, any of which will be apt to occur if the metal, when he receives it, is not right.

The mixing of iron in melting narrows down to but two sides, generally speaking. Of course strength is always to be preserved. We either want the castings soft, or medium hard. It is so easy to make them hard that we will not consider that side. Any Ohio softener No. 2 that I have ever tried—and I have melted many thousand tons—will carry fifty per cent. of mill-iron, scrap machinery or stove plate. Usually it will carry more; but taking this as a basis, we can open the grain, making softer by adding Ohio, or close the grain, making harder, by adding mill-iron or scrap.

I am no advocate of mixing three to six kinds of metal on one charge. I find it almost impossible to get clean, sound castings in that way. The best results are obtained when only two kinds of iron are used, and if anything comes wrong one can locate the trouble without much expense or time.

Clean ladles are another feature that should not be overlooked, and if a foundryman has a melter that does not keep his ladles clean and about his furnace neat, get a man in his place at once. It is anything but economy trying to get along with such a man, and a foreman or manufacturer that will countenance or allow such negligence lacks the qualifications of a successful manager.

See that your fan is large enough to supply the amount of blast necessary. Keep the belts taut, no slipping. Have the opening of the tuyere on the inside of the cupola next the bricks, one-third to one-half larger than the opening of the tuyere in the shell. Any opening will become partly clogged with fuel and slag before the heat is half through, and a large opening will hold out (with free access of wind) longer than a small one.

How long the fire should be lighted before metal is put on depends on the draught of the cupola. The proper time to put iron on is just when the blaze begins to come through the fuel in good shape, and the coke or coal on the bed begins to get red, then put on the metal and let the furnace stand one hour before putting on the blast. If a less time is allowed the metal will come down sharp, but slowly.

The very best results in mixing steel with iron to obtain strength, are secured by the mixture of boiler iron with the cast. Boiler trimmings and punchings was the quality used by the writer, and in a succession of tests it was never noticed that the adding of boiler scrap to the cast-iron produced blow holes or made the castings hard enough to cause trouble in the machine shop. Just how much boiler scrap can be added without incurring serious results I have not determined, but in one test, fifty per cent. boiler scrap to a like amount of Ohio Scotch (No. 2) I found the mixture no harder than if good machinery scrap alone were used with the Ohio, while the strength of the castings produced from the mixture was greater by one-fifth than when our best gilt-edged mixture was used.

It was also found in experimenting that our strongest test bar came from a mixture of three hundred pounds of boiler scrap added to seven hundred pounds of Ohio Scotch (No. 2.)

Some test bars from the above mixture developed (under test) one-third greater strength than we usually received from our ordinary mixtures, and we learned also that increasing the admission of boiler steel to the charge until one-half of the scrap was used to a like amount of the pig metal, did not tend to make the castings stronger than when the parts three and seven were used. A piece of the broken test bar of the above mixture was heated to a dull cherry red in the blacksmith's fire, and flattened down under a steam hammer to one-half inch in thickness before breaking, and when it did break it was not off short, but in a stringy manner. Another piece was flattened (in like manner) on the anvil with blows from a sledge hammer—after being heated in the manner one would heat steel before hammering.

Other steels than boiler steel, if not used carefully in mixing, will surely harden the casting, and will also have a tendency to leave fine blow holes, and although they may not impair strength in the castings, no one likes to meet them when boring, planing or milling in the machine shop.

Old rails will mix well with cast-iron, giving strength and cleanliness, but usually around a foundry there are no appliances for cutting them up into suitable lengths to admit of being placed in the cupola.

Old files must be used very sparingly, as there is something about the nature of them which makes cast-iron very hard. They can be used (in a small way) by breaking the files into pieces about two inches in length and dropping them into the bottom of a bull ladle (previously warmed) then catching the iron in the bull hot from the cupola, and, after waiting a short time to give the files a chance to melt, stirring the mixture vigorously with a rod, and pouring the metal into the mold before allowing it to become dull enough to show cold shuts on the casting.

An ordinary mixture of soft cast-iron will stand an admission of one part of old files to thirty of cast-iron (when mixed in a ladle), and will produce a casting that will finish nicely, take a very bright polish, and at the same time have increased strength.

Charge the boiler scrap into the cupola in the following manner: After having put in the bed of fuel (coke or coal) in the bottom of the cupola, put three hundred pounds of boiler scrap and seven hundred pounds of Ohio iron, or some equally good softener—mixed indiscriminately—on the fuel bed, then one hundred and twenty pounds of coke, and the same amount of metal, and continue so using through the heat, or as long as you wish to use the boiler steel scrap on the charge.

When the mixture first commences to melt

it will come down to the tapping hole in a slaggy, thick manner, and will have a tendency to entirely clog the opening. Stand ready with a small rod and keep the passage cleared away and open until the metal comes quite hot. When it is running clear and clean, stop up the tapping hole and proceed in the ordinary way; you will have no further trouble and the boiler scrap will mix and run as fluid as any iron. A slight tendency to shrink will be noticed in the castings, but not where a high head and large risers are used, and not in any case to such an extent as could not be easily gotten over by exercising a little good judgment in gating and placing risers.

In cupolas of less than 36" diameter use one-half of the above mixture on each charge.

Mr. W. B. Dunning, Geneva, N. Y., president of the New York Central Iron Works at Geneva, and general manager of the Seneca Lake Steam Navigation Company, writes us:

"I notice locomotive builders have finally commenced building locomotives with down draught—a plan I have advocated for the past twenty years. As all the draught is made by the exhaust steam, it should be downwards, carrying with it the sparks and cinders below the cars, and not above them, and into the windows.

"I would like to see another experiment tried, viz., moving the cranks of the drivers with slotted driving bars, dispensing with connecting rods and parallel bars, getting rid of the vibration of these rods. I never feel safe when riding with an engineer over these rods, especially when making a mile a minute, which is frequently the case when the engineer has *company*."

[We have no knowledge of locomotives being built with a down draught, such as is contemplated by Mr. Dunning, viz., taking the products of combustion out at the bottom of the smoke-arch.]

Coming down to the facts of the case, although it is fashionable to charge poor boiler making with a good share of the boiler explosions that occur, it is very seldom that we hear of such an explosion when a competent man is in charge. The great majority of boilers that fail to hold together are managed by so-called engineers who know next to nothing about what they have to deal with; saw-mill boilers run by men who learned their trade sawing boards, and who really know no better than to hang weights on the safety-valve lever when the engine slows down; threshing machine boilers run by farmers' boys with an expansive turn of mind, and others cared for by men who will work cheap. Mind, we do not say that a boiler has never exploded with a good man in charge, but such occurrences are rare. Nor do we say that some boiler makers do not use poor material and do poor work. We have no excuse to offer for men who, under any inducement, "scamp" boiler work. What we do say is that it is our opinion that a great majority of boiler explosions are caused by poor management rather than by poor material and workmanship. Caused by the gross ignorance of the men who are in positions they have no right to be in. What is required are stringent laws that shall provide for the periodical inspection of every boiler, under whatever condition operated, either by insurance inspectors or inspectors appointed by the State, and such an examination of engineers as shall permit only competent men to manage them. To these laws might be added a law providing any punishment thought necessary for the boiler maker who cheated in his work. These laws, properly enforced, will spare people the horror of reading of so many boiler explosions.

The twenty-four hour system is in operation on the principal railways in India, and is said to be thought a decided improvement. The traffic on these roads has more than doubled during the past ten years, which speaks of general prosperity.

Machinists' Supplies and Iron.

NEW YORK, January 3, 1890.

Nothing seems definitely settled yet in regard to prices for the new year, and it is difficult to say what values are precisely. Some furnaces have shut down under an agreement by the owners, who claim that high freight charges and high prices of coke make it impossible for them to do business except at a loss. Nominal quotations are unchanged, though the less known brands of iron are obtainable at considerable concessions.

Iron—American Pig—We quote No. 1 Foundry, standard Northern brands, $16.50 to $17.50; No. 2, $16 to $16.50; Gray Forge, $15 to $15.50; Southern brands No. 1 Foundry, $16.25 to $16.75; No. 2, $15.75 to $16; No. 3, $14.25 to $14.50.

Scotch Pig—The demand continues very light, and is only to supply the immediate wants of consumers.

We quote Coltness, $24.50; Dalmellington, $22 to $22.50, and Eglinton, $20.50.

Copper—No change of importance has taken place, consumers evidently expecting prices to go still lower, and consequently showing no inclination to make contracts with the Lake companies. Lake has been bought at 15c., and there are rumors of still lower prices having been accepted. Nominal quotations for other brands are 13c. to 15c.

Lead—Very little is being done, and the market is dull, with prices nominal. Buyers evidently expect to cover their requirements at lower figures than are now obtainable. Values are at about 4.10c. to 4.20c.

Spelter—The market has ruled dull, the immediate wants of consumers seeming to be well supplied.

We quote ordinary brands of Western at 5.90c. to 6c.; choice, 6¼c. to 6¼c.; refined, 7¾c. to 8c.; Silesian, 7⅜c. to 7½c.

Tin—Prices have declined somewhat in London, and the effect of the decline is seen here in easier prices, though there has been very little business transacted at the lower prices. Dealers' prices for job lots are 20¼c. to 20½c.

Lard Oil—The demand has been moderate, and Prime has sold at 48½c. to 49c.

✲WANTED✲

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Wanted—Draftsman; first-class draftsman. Niles Tool Works, Hamilton, Ohio.

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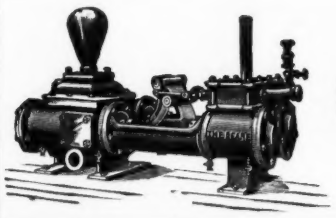

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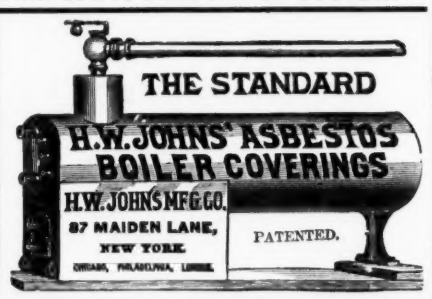

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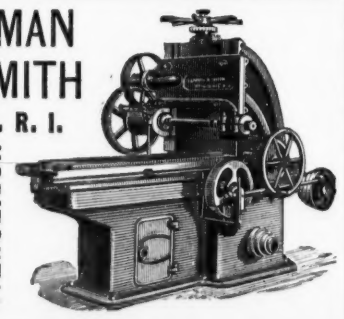

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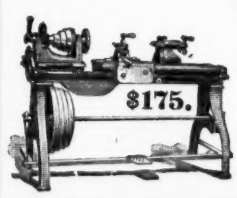

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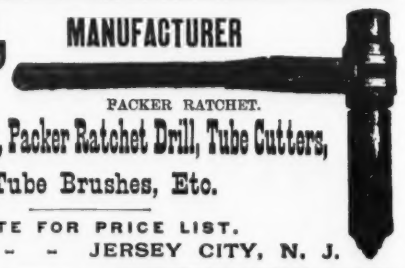

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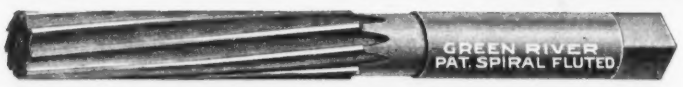

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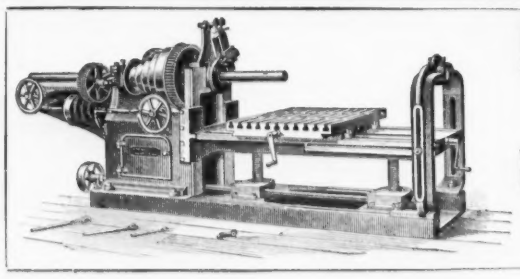

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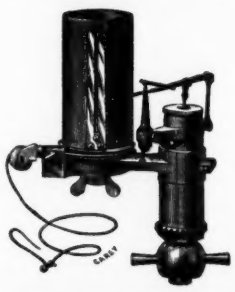

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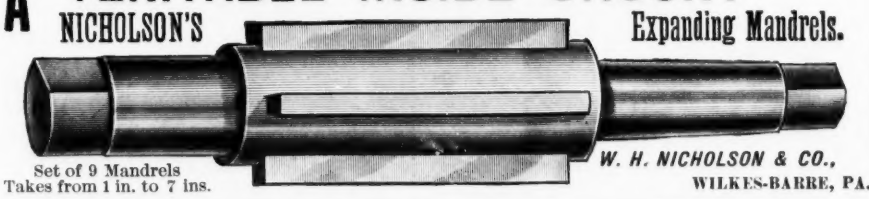

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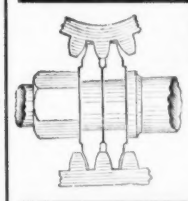

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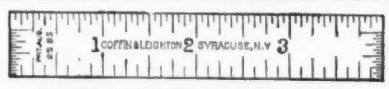

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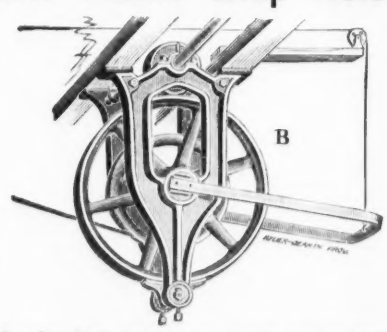

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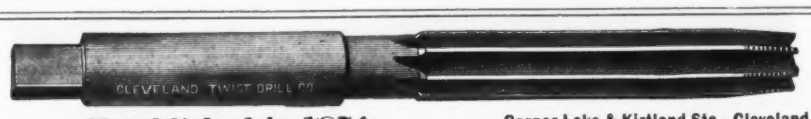

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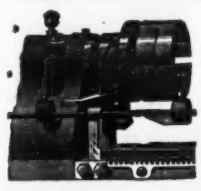
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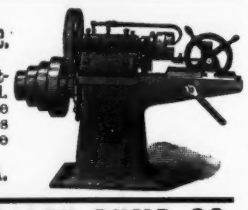

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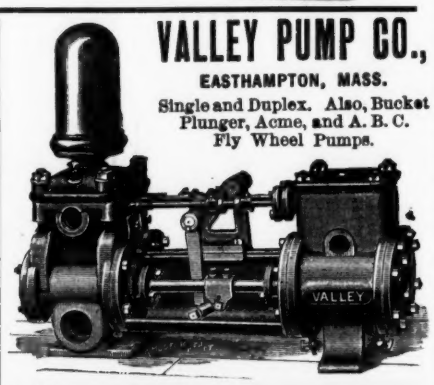

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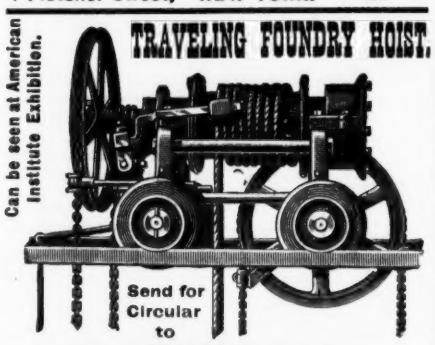
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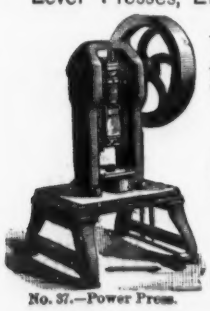
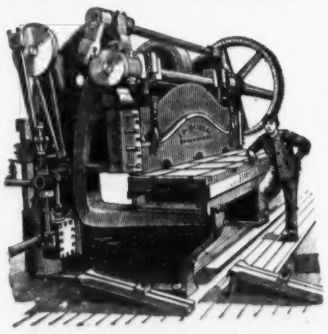

No. 37.—Power Press.

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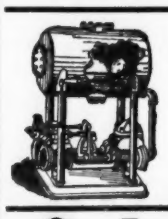
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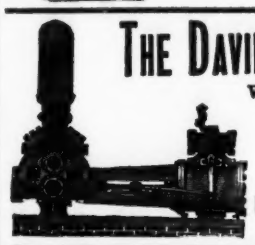
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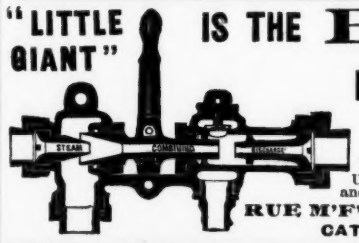

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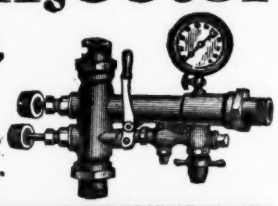

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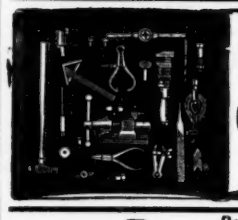
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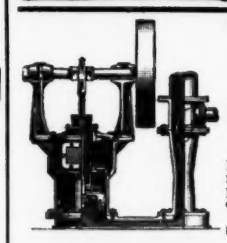
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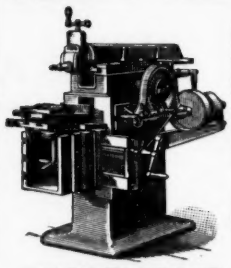
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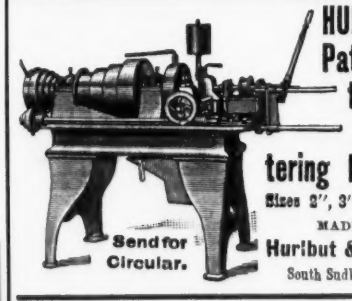
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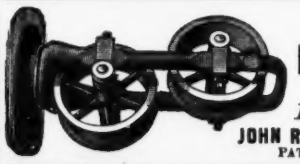
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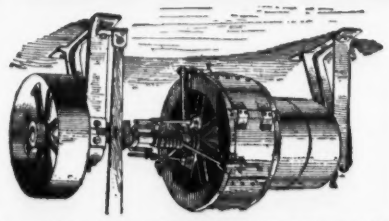
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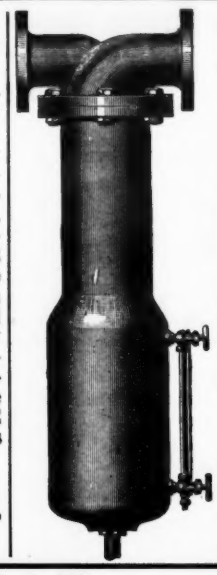

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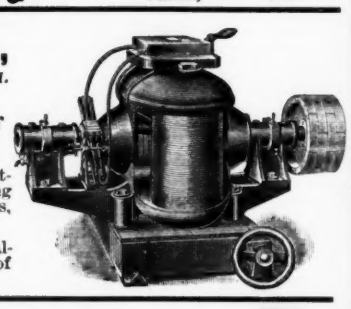

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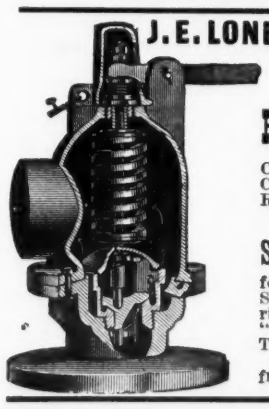

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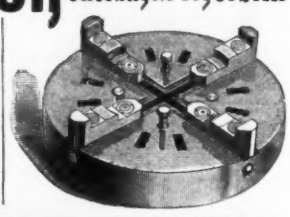

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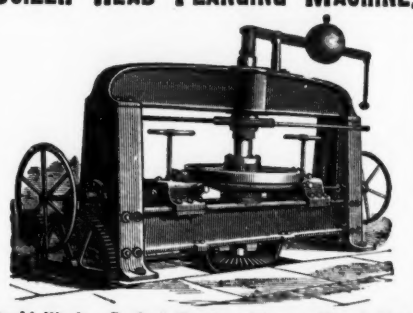

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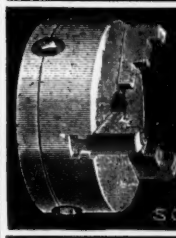

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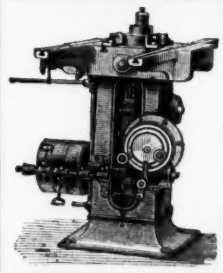

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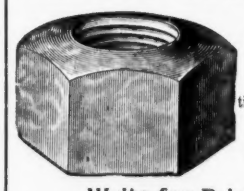

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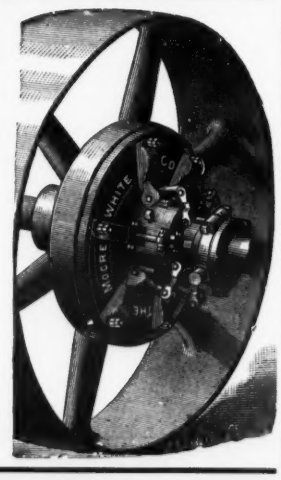

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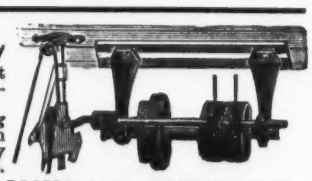

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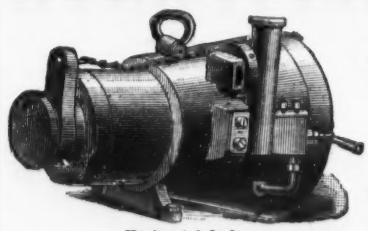

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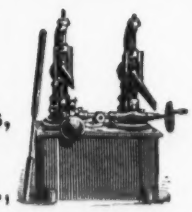

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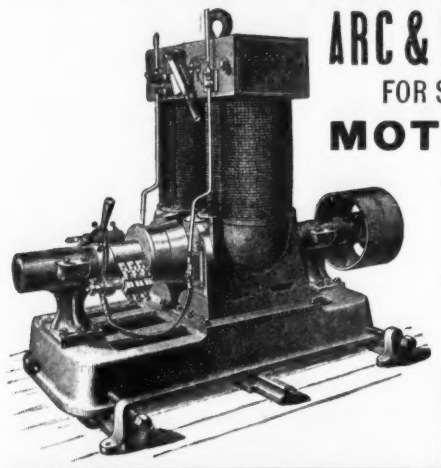

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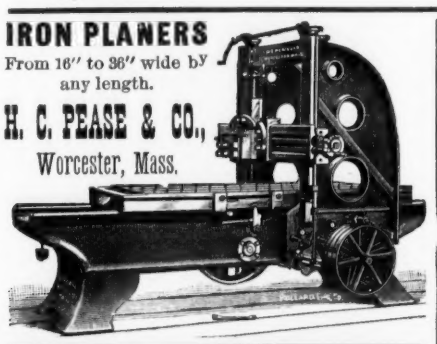

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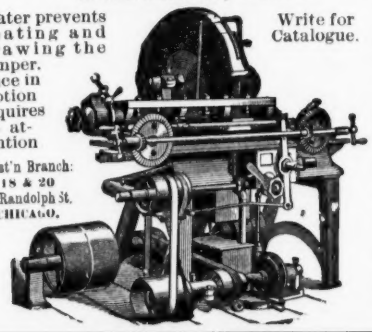

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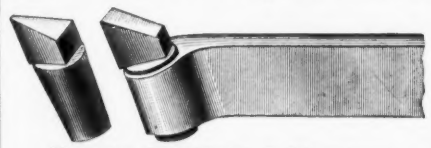

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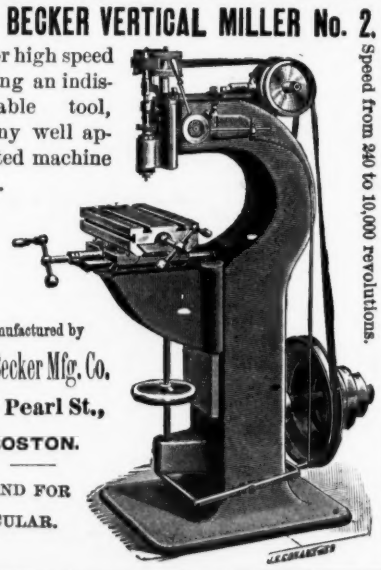

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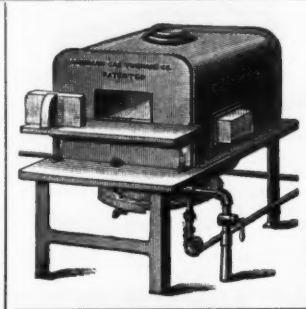

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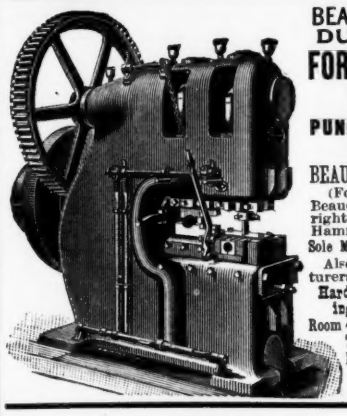

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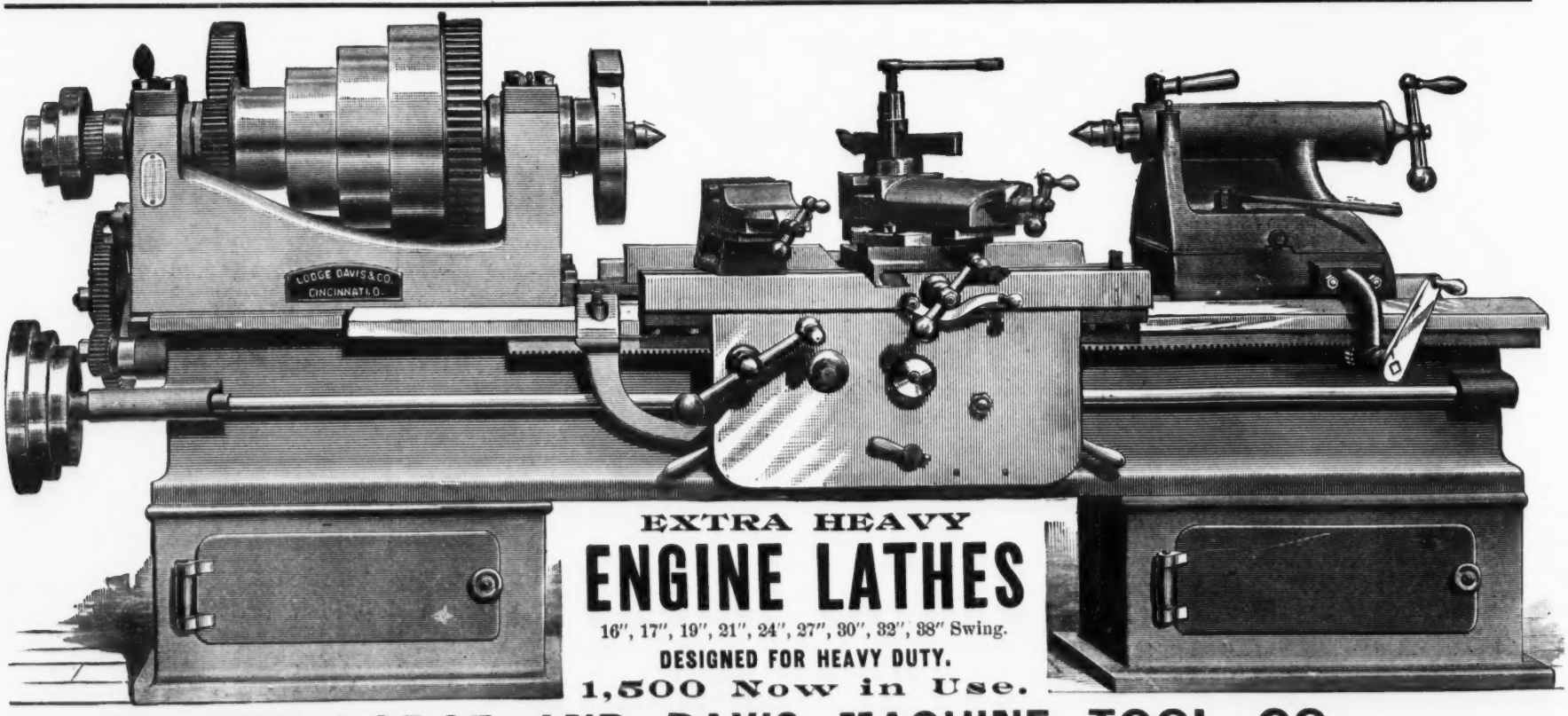

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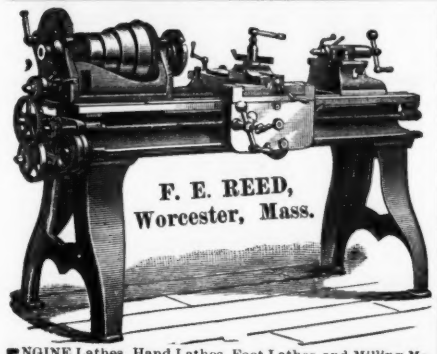

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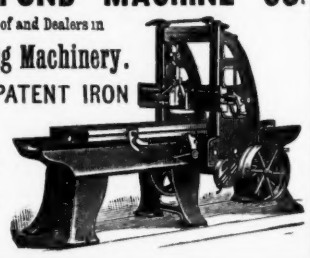

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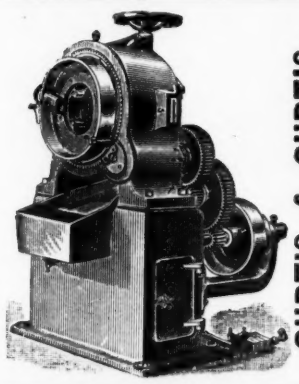

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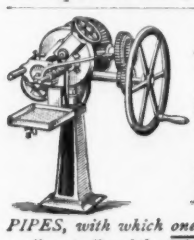

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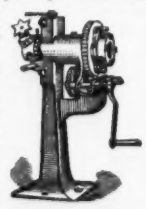

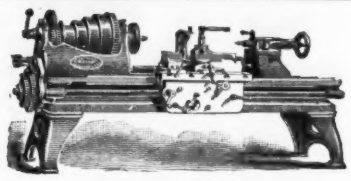

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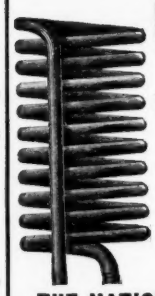

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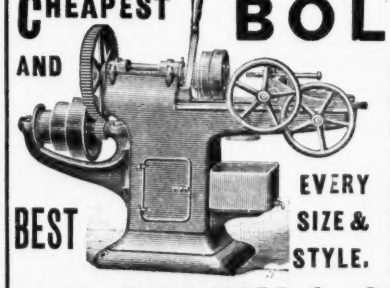

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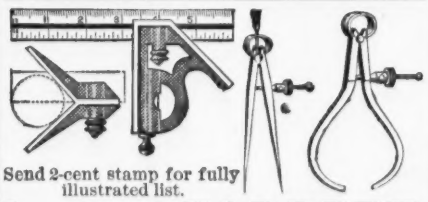

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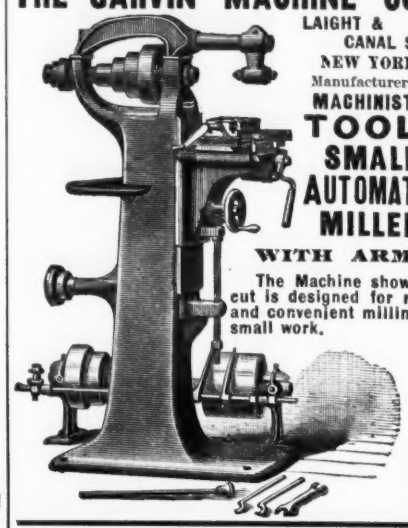

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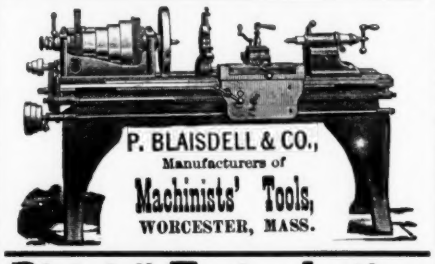

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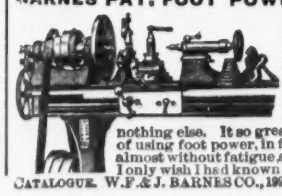

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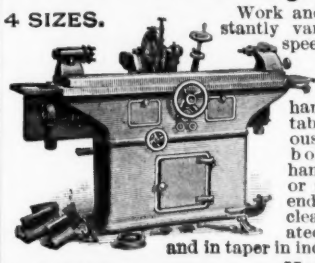

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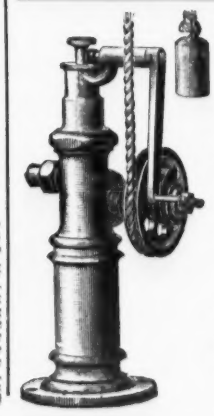

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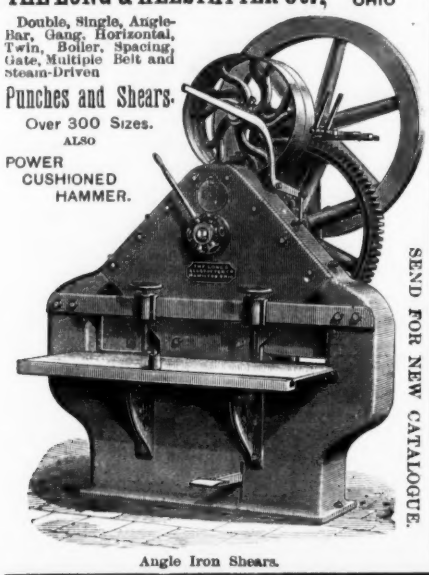
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The best and most convenient Drawing Table in the world.
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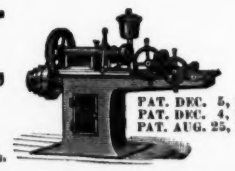
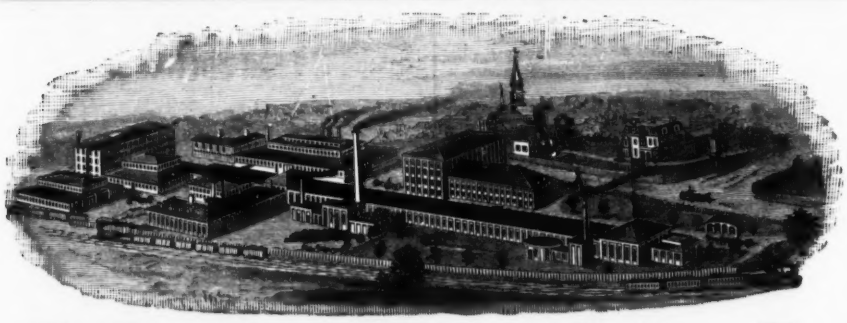

PAT. DEC. 5, 1882.
PAT. DEC. 4, 1883.
PAT. AUG. 25, 1885.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PROVIDENCE, R.I.
Incorporated June, 1856; Established by
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These works have been fully equipped, at great cost, with heavy special tools, of his invention, for the manufacture of this perfected engine, which is a guarantee of superiority in workmanship, and interchangeability of parts never before attempted in the line of steam machinery.
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Especially adapted for compound and triple expansion engines requiring superheated steam and at very high pressure.

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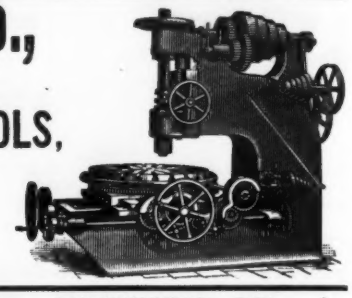

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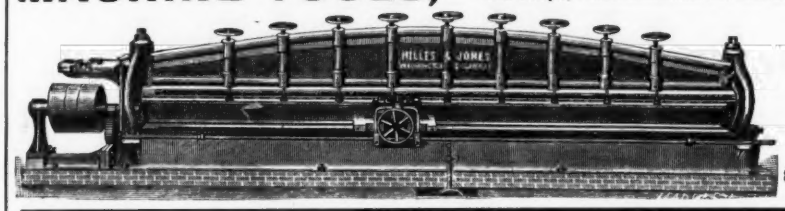
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Eight Sizes.
8'x20' length of cut.

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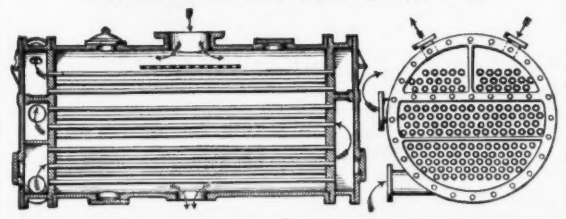
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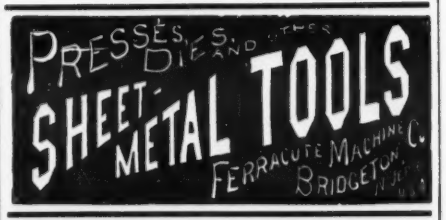

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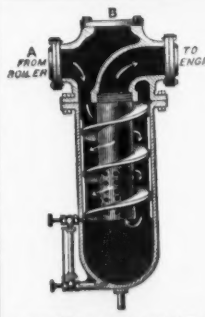

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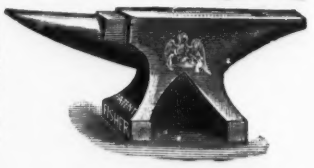

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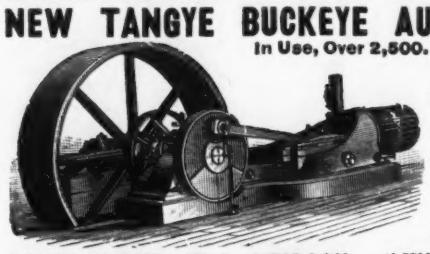

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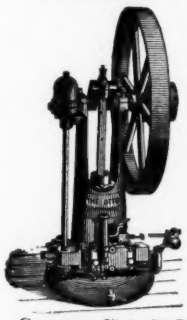

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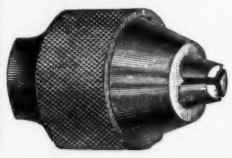

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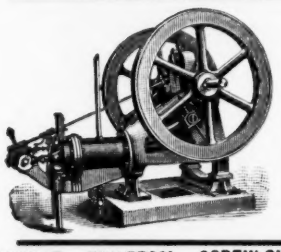

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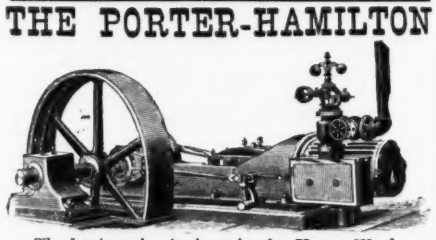

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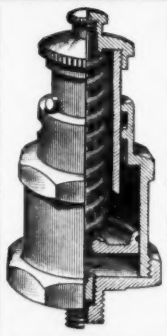

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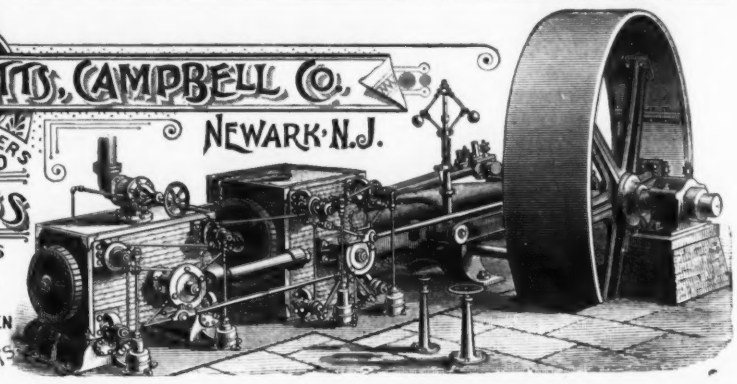

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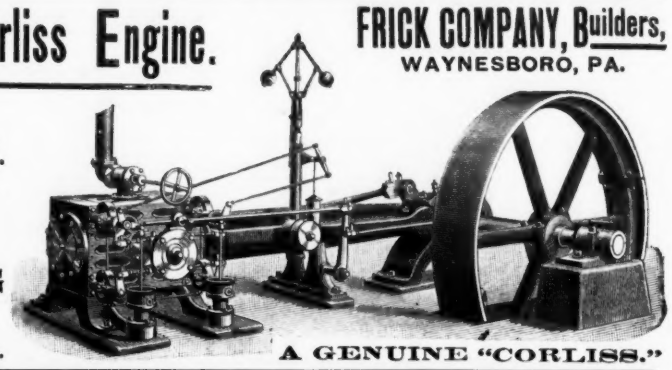

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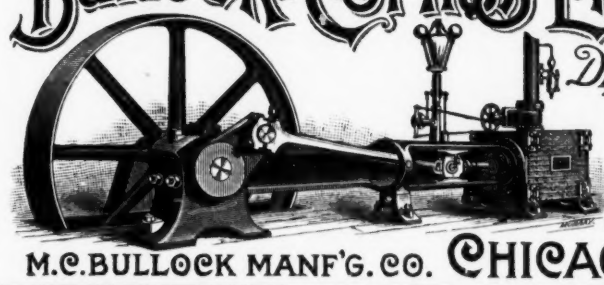

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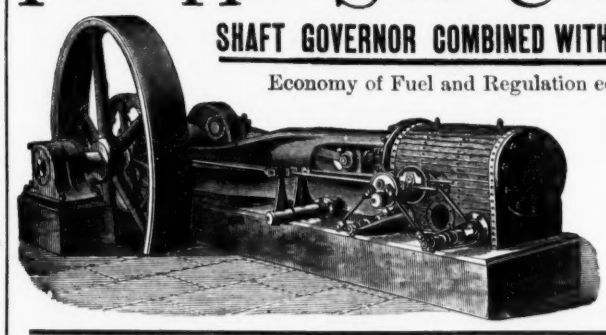

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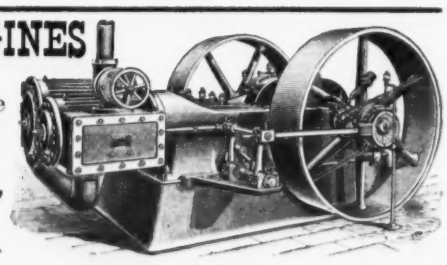

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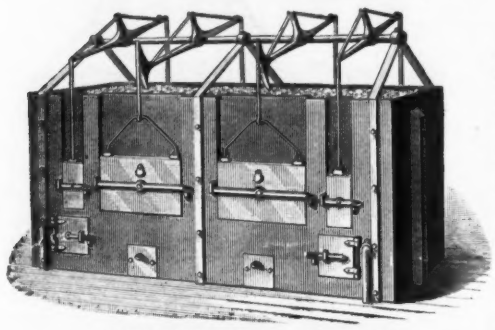

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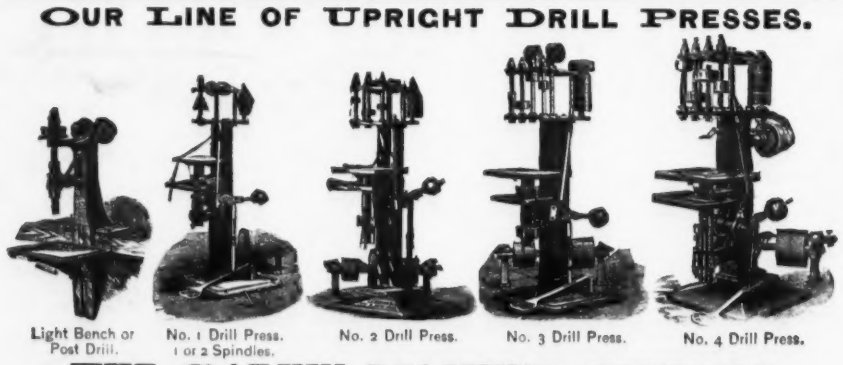

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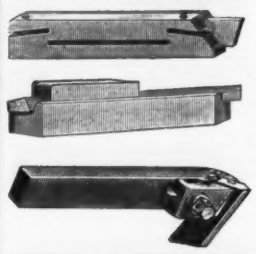

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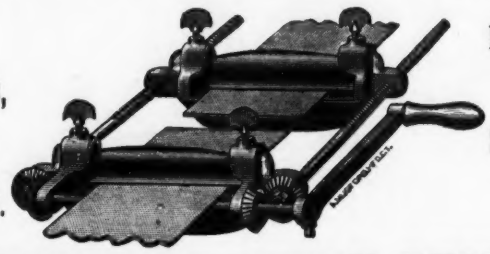

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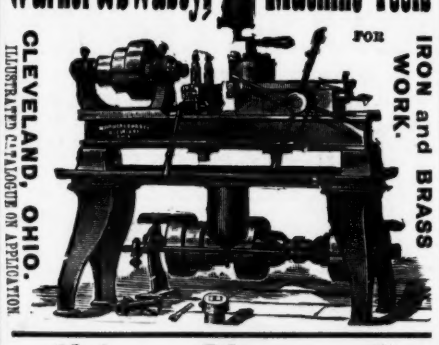

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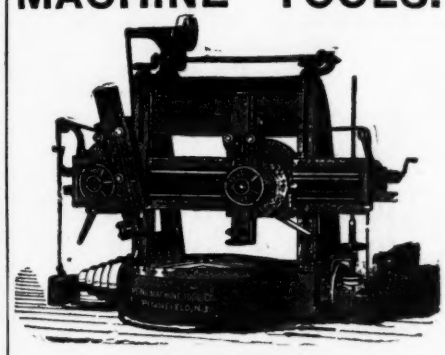

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